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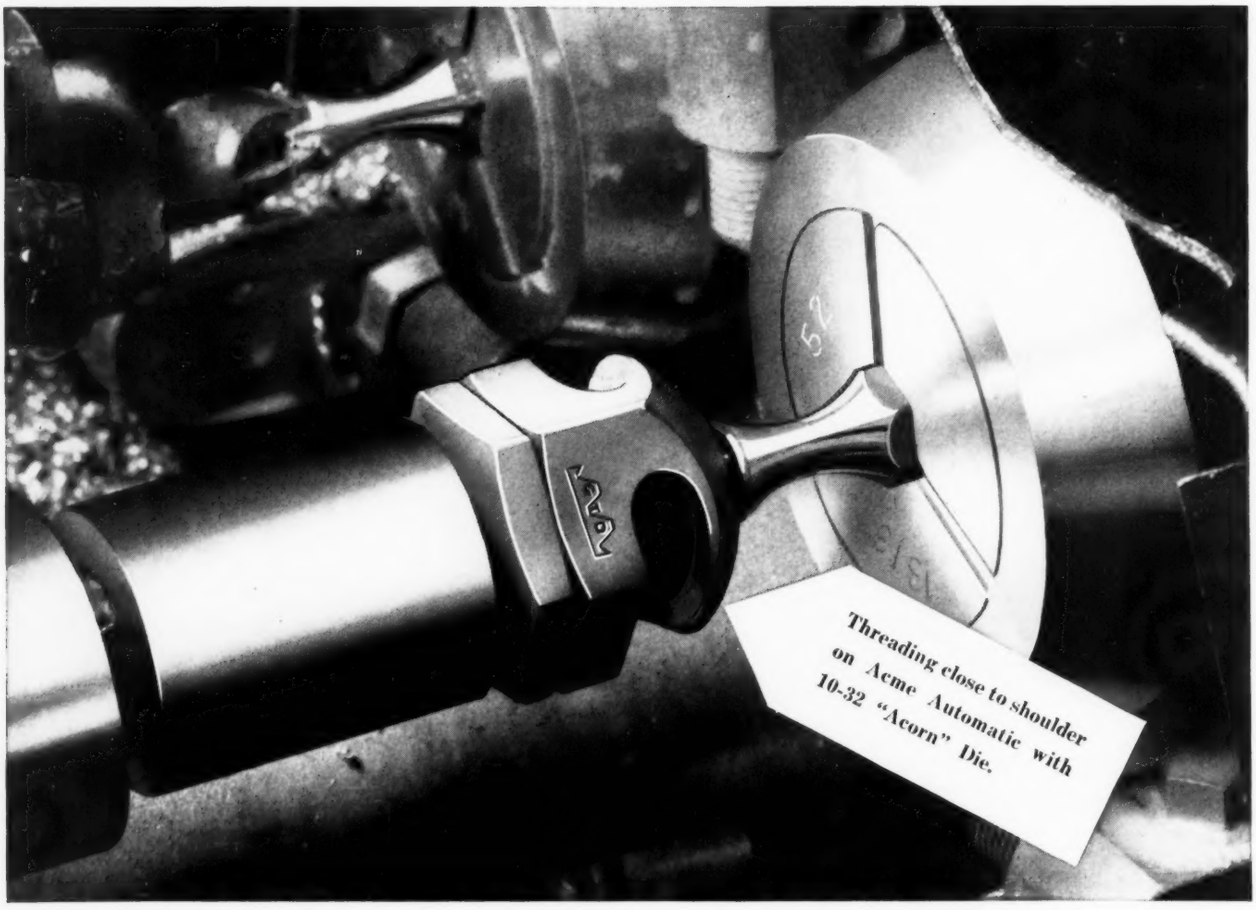

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The National Defense Program is now well under way and many leading manufacturing plants are engaged in the building of Army and Navy equipment. November MACHINERY will have several articles describing how manufacturers are meeting the needs of national defense by diverting their equipment from the manufacture of peaceful products to the production of war materials. In addition, there will be articles on Advanced Practice in the Polishing of Die-Castings and on Bending Press Dies, together with the usual articles on tools and fixtures, ingenious mechanical movements, and new shop equipment.

Volume 47

Number 2

OCTOBER, 1940

PRINCIPAL CONTENTS OF THIS NUMBER

For Complete Classified Contents, See Page 188

Modern Methods in Gear Manufacture . By GARDNER YOUNG 107

Lockheed Builds Planes for Commerce and Defense 117
By J. H. SREENAN

Drill Points for Deep-Hole Drilling . . By F. O. HOAGLAND 120

Flame-Cutting and Welding in the Preparedness Program . . . 122
By D. E. ROBERTS

Editorial Comment 126

An Industry That is Ready for the Defense Program—
Impartial Testing of Shop Tools and Equipment—
How Industry Makes Social Security Possible

Making Ring-Weights for Balancing Radial Aircraft Engine Crankshafts . . . . . By WERNER I. SENGER 130

Photo-Electric and Electronic Controls in the Machinery Field . 140
By BENJAMIN W. STEVERMAN

Hydraulic and Mechanical Methods of Forging Shells . . . 145

Twenty-Second Annual National Metal Exposition 147

Condensed Review of Some Recently Developed Materials . . 148

DEPARTMENTS

Engineering News Flashes 124

Ingenious Mechanical Movements 127

Design of Tools and Fixtures 135

Ideas for the Shop and Drafting-Room 139

New Trade Literature 156

Shop Equipment News 159

News of Industry 178

Product Index 283-297

Advertisers Index 299-300

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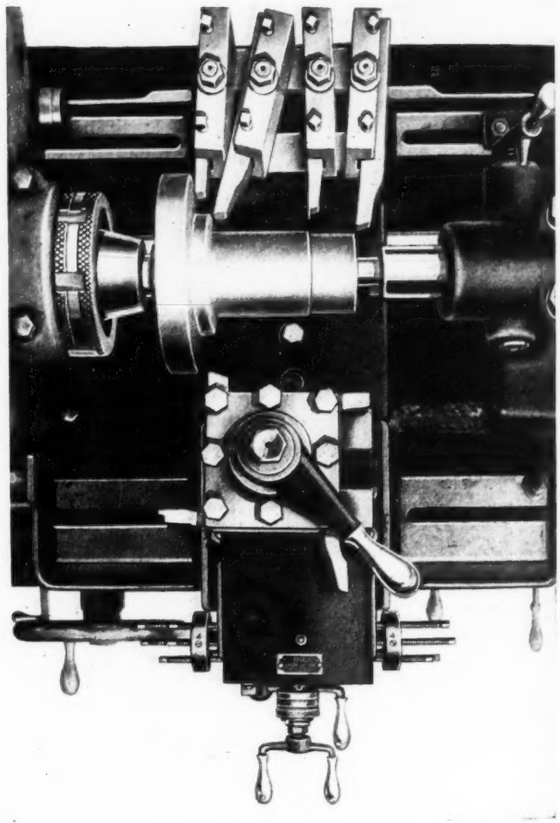

The operations on this gear blank require additional tooling and the four Swivel Tool Holders have been substituted for the High Duty Tool Block in order to perform the facing and necking operations.

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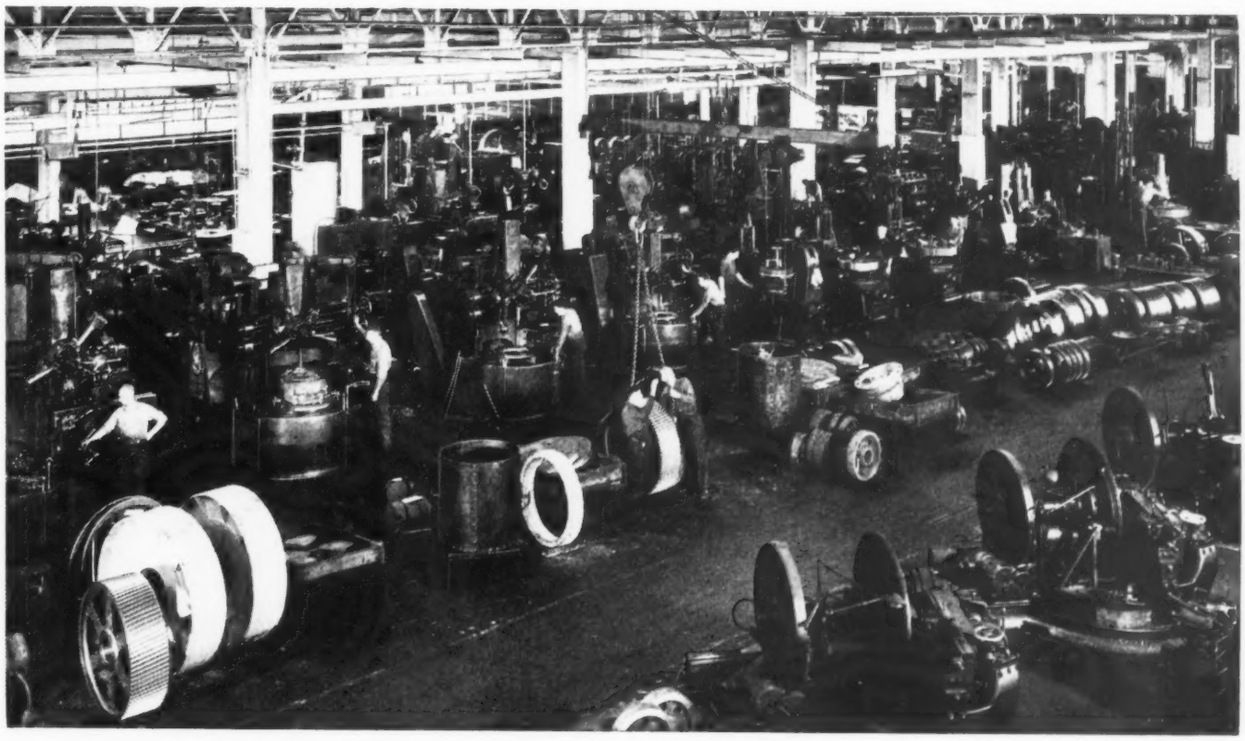
Volume 47 NEW YORK, OCTOBER, 1940 Number 2



Modern Methods in Gear Manufacture

By GARDNER YOUNG, Gear Technician
Westinghouse Gearing Division, Pittsburgh, Pa.

The Nuttall Works of the Westinghouse Electric & Mfg. Co. Produce Some $4,000,000 Worth of Industrial Gears Annually. The Methods Used in This Plant to Secure Accuracy and Dependability of the Gears are Reviewed in This Article

ONE of the earliest manufacturing establishments in the country devoted to the manufacture of industrial gears was the R. D. Nuttall Co., established in Pittsburgh in 1887. The business was started with a capital of $500 and one gear-cutting machine. In 1929, it was taken over by the Westinghouse company and has been operated since as a division of that organization. Today the plant covers approximately six acres, and has 250,000 square feet of manufacturing floor space. The annual output is some $4,000,000 worth of industrial gearing.

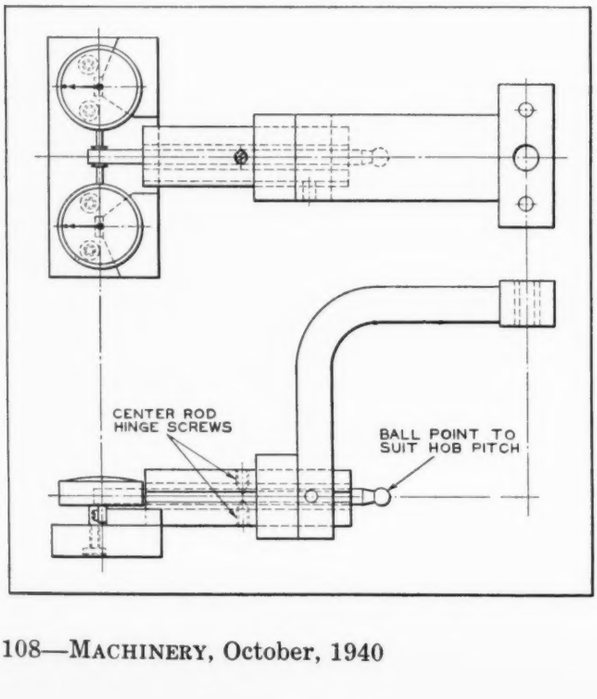
The general methods of gear manufacturing in a modern plant are essentially the same as those developed many years ago. Most of the refine-

Fig. 1. All Steel Received is Checked in the Laboratory to Determine its Exact Carbon Content. This is of Especial Importance when the Gears are to be Heat-treated.

ments made have been in the machines and tools for cutting the gear teeth and in the more rigid control of the various operations.

The first requirement in producing high-grade gears is specialized engineering. Gearing problems must be thoroughly studied, and all details considered before the drawings are sent into the shop. When the raw material arrives, the rigid control of manufacturing starts. The material is first inspected to determine roughly that the sizes are right, and in the case of forgings or castings for web- or spoke-type gears, they are inspected for symmetry, as this is important in securing balance of the finished gear. An unevenly balanced gear is noisy and wears rapidly, due to vibration. At the same time, the material is also inspected for any visible defects.

Fig. 2. Gage that is Employed for Centering the Hob on a Gear-hobbing Machine



After this preliminary inspection, sample drillings are taken and sent to the metallurgical laboratory, the material and drillings being tagged for future identification. In the laboratory, the drillings are carefully analyzed to see whether the material agrees with the specifications. The exact chemical analysis is very important, especially when the part is to be heat-treated. The laboratory also inspects the material for grain structure and flow. One of its duties is to develop new heat-treating methods to improve the gear products.

When the material has been approved by the laboratory, it proceeds to the various machining operations. The smaller pieces are rough-turned, bored, and faced, and then heat-treated in furnaces equipped with modern heat controls. They are next finish-machined and ground, after which they are sent to the gear-cutting department. The blanks for the larger gears, if castings, are first normalized and then rough-machined, after which the teeth are rough-cut. They are next stress-relieved and heat-treated to relieve any internal stresses in the material that might cause warpage. The succeeding operations are the finishing of the bore and the assembling of the gear blank on its shaft. Then the outside diameter and sides are finish-machined, the accuracy of this operation being insured by indicating and truing the shaft to 0.0003 inch or less on the running journals or bearing fits. This is essential, as the gear pitch diameter must run true with the journals to insure a quietly operating and long wearing set of gears. Eccentricity causes noisy operation and premature wear.

The next operation is that of cutting the teeth or, where these have already been rough-cut, finishing them. For this operation, the most important step is the setting up of the work and the adjustment of the machine. If these operations are slighted in any way, the care given to preceding and succeeding operations is nullified.

The blank must be mounted and clamped on a solid support or fixture, with the support as close

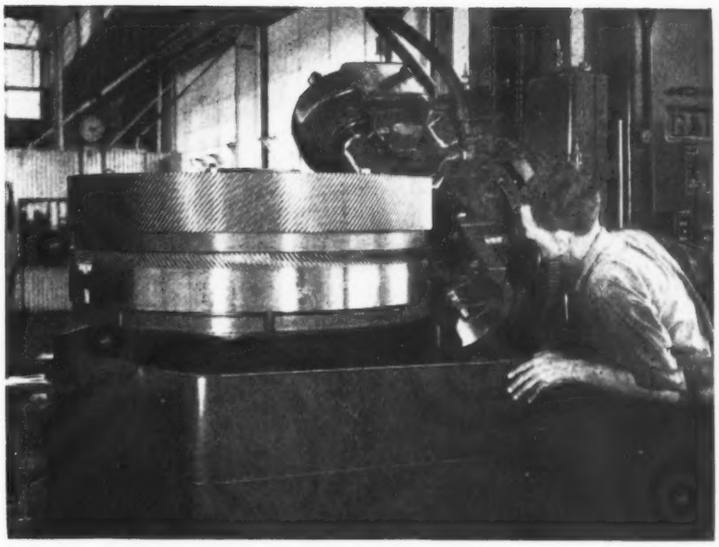


Fig. 3. When Gears are Mounted in the Gear-cutting Machines, it is Important that They be Supported as Close as Possible to the Point where the Cut is being Taken.

to the cutting point as possible. Fig. 3 shows such a method of supporting a gear while rough-cutting. When finish-cutting, the shaft is in place and the gear is trued up, using the journal or bearing fits on the shaft as the indicating points. In clamping the gear, the clamps must be tightened evenly to avoid springing the work.

When the hobbing machine is being prepared, care should be taken in mounting the change-gears. These must be clean, and free from broken or mutilated teeth which would prevent smooth operation. The change-gear studs and bushings must also fit snugly for the same reason. When in mesh, the gears should turn freely, with only a few thousandths of an inch backlash, as excessive backlash would allow vibration to be transmitted to the point of cutting, causing a rough finish.

The next step in the preparation of the machine is the setting up of the hob. The hob-arbor must be clean and free from burrs. The spacing collars and nut must be clean and their faces free from markings. The faces must also be parallel within a few ten-thousandths inch. The hob must be clean and its ends parallel; it must run true within 0.0002 or 0.0003 inch, and must be accurately centered.

A special gage, as shown in Fig. 2, has been designed for centering the hob. This gage consists of an arm, mounted on the hob swivel saddle, which supports a rod, ball-shaped on one end and flat on the other. The ball fits between two hob teeth, while the other end is in contact with two dial indicators, one on each side, which are so set that when both read zero, the hob is absolutely in the center. The rod is supported by and swivels on two pointed screws, which act as bearings. The gage is easily checked and reset when necessary by the use of a bushing, the bore of which fits the rod and the outside of which fits the bore of the boss through which the rod passes. Thus the rod is held central and the indicators can be reset.

After the gears have been cut, the measuring and inspection of the teeth follows. Figs. 4, 5, and 6 show three types of gages or instruments that are in daily use on production work.

In Fig. 4 is shown a regular gear-tooth vernier caliper for the inspection of chordal dimensions. Fig. 5 shows a pitch and spacing gage, with which the pressure angle, the symmetry of the tooth form, and the spacing are inspected by the use of a 0.00005-inch indicator. This gage is used for gears that are too large to be inspected in the machines shown in Figs. 7 and 8.

Fig. 6 shows another gage, which is used as a check on finished gears for measuring the normal pitch. This gage checks within an accuracy of 0.00005 inch.

Figs. 7 and 8 illustrate precision machines used for the inspection of the smaller gears. The machine in Fig. 7 inspects the involute and the spacing. The one in Fig. 8 is used for helical lead inspection. The indicators on both machines read

Fig. 4. Chordal Dimensions are Checked with a Regular Gear-tooth Vernier Caliper.

Fig. 5. Pitch and Tooth Spacing are Checked with This Gage, which Reads to 0.00005 Inch.

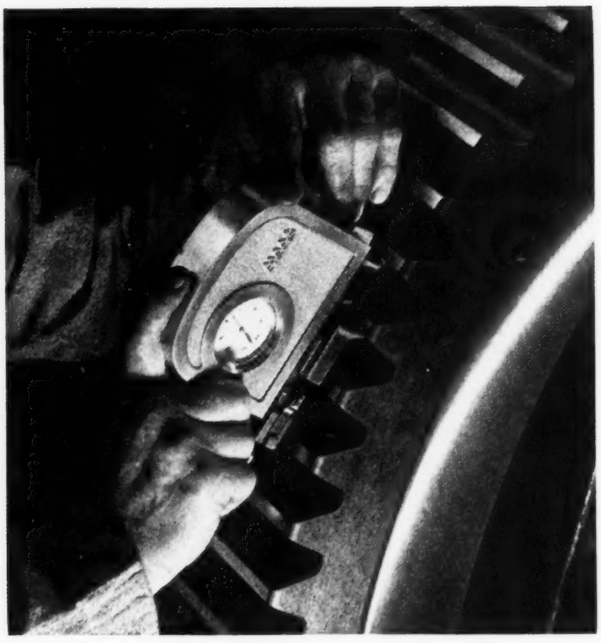


Fig. 6. This Gage is Used to Measure the Normal Pitch of Finished Gears to 0.00005 Inch.

to 0.0001 inch, and the indicator rods have a 4 to 1 ratio, which makes the instrument very sensitive. The moving parts of the machines are so constructed that there is no lost motion which could introduce an error in the indicator readings. All motion is controlled by a sine bar, which is mounted on a movable carriage. The sine bar is adjusted to the various positions required by the use of precision gage-blocks.

The first gear from each set-up is put through these inspection operations, and if it is found to be within the limits required, the inspector gives the production department permission to proceed. The same inspection is also made if the cutter should be repositioned or changed. This is not, however, the only time that inspections are made, as the inspector, at intervals, takes gears at random from each machine in the production department and subjects them to inspection. By these two methods an accurate control of quality can be maintained.

New Developments in Gear-Cutting Machines

Gear-cutting machines have of late been greatly refined and their rigidity increased. Fig. 9 shows a gear set up in a modern gear-hobbing machine. The size and the rigidity of the machine are obvious from the illustration. The work-table is made unusually heavy to resist clamping strains. The feed-screws are of fine pitch for accuracy, and of large diameter for strength. The fine-pitch precision index worm-wheel is completely sealed in the housing in the bottom of the machine. The worm of this mechanism has a dual lead, the lead being a little longer on one side than on the opposite side for the purpose of taking up any wear that may occur.

Until the introduction of this type of index worm, the only way to take up wear was to remove the shims and decrease the center distance. Decreasing the center distance is not detrimental to accurate tooth spacing, but errors due to in-

Fig. 7. Checking Finished Pinion for Correct Tooth Spacing and Profile. The Tolerance for Tooth Profile Error is 0.0002 Inch.

Fig. 8. Precision Machine Employed for Inspecting the Helical Lead of a Finished Gear, the Indicator Reading to 0.0001 Inch

correct tooth contact, misalignment, and interference were often encountered and had to be eliminated by the long process of scraping and fitting. With this new type of worm, however, the relationship between the worm and gear is not changed. To take up wear, the worm is moved along its axis by loosening one end-retaining nut and tightening the other, thus bringing a thicker tooth section into the contact zone. By this method, backlash can be adjusted very closely, and the tooth spacing improved.

The hob-arbor is supported on the driving end in a long, heavy quill having a tapered bearing for adjustment, which must be kept snug. The outer end of the hob-arbor is supported by a heavy, removable bracket, and is carried in a tapered bushing by means of which all play is eliminated and compensation for wear can be made.

Inspection of Gear Hobs

One of the most important factors is the hob which cuts the gear teeth. Errors in this cutting tool obviously nullify all other precautions taken to insure precision. The hobs used are to some extent special, and are designed by the Nuttall Works. The limits are very close, and no hob is accepted from a manufacturer that does not check within the limits. These limits are approximately one-half the standard Class A limits for ground form hobs in use at the present time.

Each hob is thoroughly inspected when received, and must pass all checks for accuracy before being issued for use. This inspection covers tooth profile, lead, gash-spacing, radial position of tooth sharpening, run-out, and hardness. In the machine shown in Fig. 10, a hob is mounted on an arbor located between centers. A master index-plate for the required number of gashes in the hob insures proper indexing for the gash spacing. A dial indicator finger checks any deviation from the correct gash-to-gash spacing and from a true radial cutting surface, both of which must be

Fig. 9. A Modern 96-inch Gear-hobbing Machine of Massive Proportions and Rigid Design

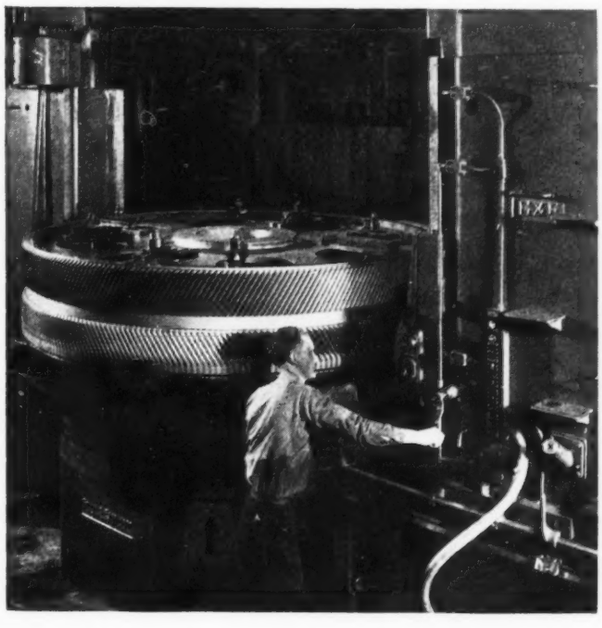


Fig. 10. All New Hobs are Checked to Predetermined Tolerances before being Used.

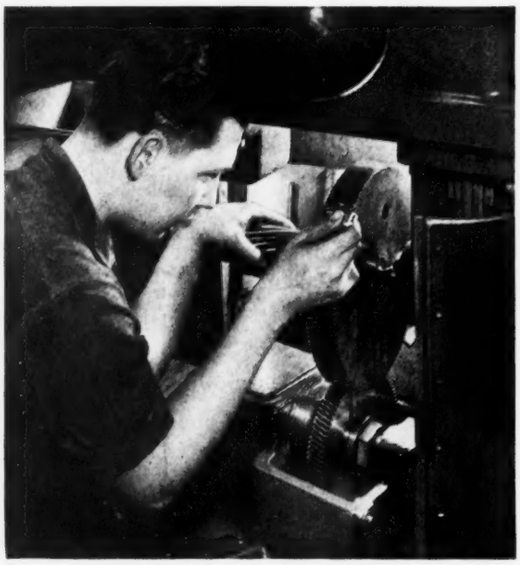


Fig. 11. A Gear Shaving Machine Used for the Final Finishing of Gears and Pinions

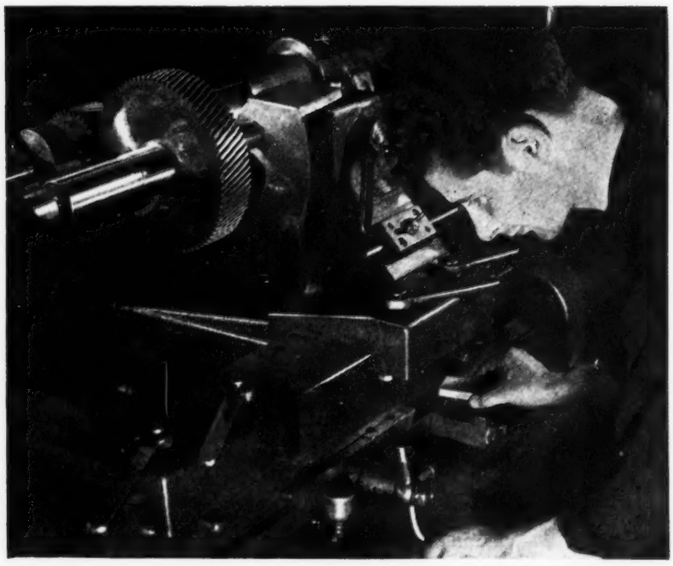


Fig. 12. Machine for Running-in Gears that are to be Mounted at Accurately Specified Center Distances

within 0.001 inch. The tolerance for cumulative gash-to-gash spacing is 0.003 inch. The tolerance on hobs for gears of 6 diametral pitch and finer is 0.00025 inch for tooth-to-tooth lead spacing, and 0.001 inch for cumulative tolerance, end to end. The tooth profile tolerance is 0.0002 inch, and the outside diameter must be held to within 0.0003 inch. The hub eccentricity and run-out of the hub face are checked to a tolerance of 0.0005 inch; the bore tolerance is 0.0002 inch.

The truing hubs on each end of the hobs are special in that they are 5/16 inch long and straight rather than like the standard hub, which is 1/8 inch long and has a 45-degree angle. These hubs are very important, as they are used for truing up the hob in inspecting and checking it on the hobbing machine, sharpening machine, and again in the inspection operations. The design of these hubs lends itself to accurate and duplicate set-ups.

When a sharpening operation is required, the operator trues up the hole in the machine to these hubs before sharpening; and when inspecting the accuracy of the sharpening, the inspector also trues up the hob to these hubs. After each sharp-

Fig. 13. Machine for Observing Wear of Gears Made of Different Kinds of Materials

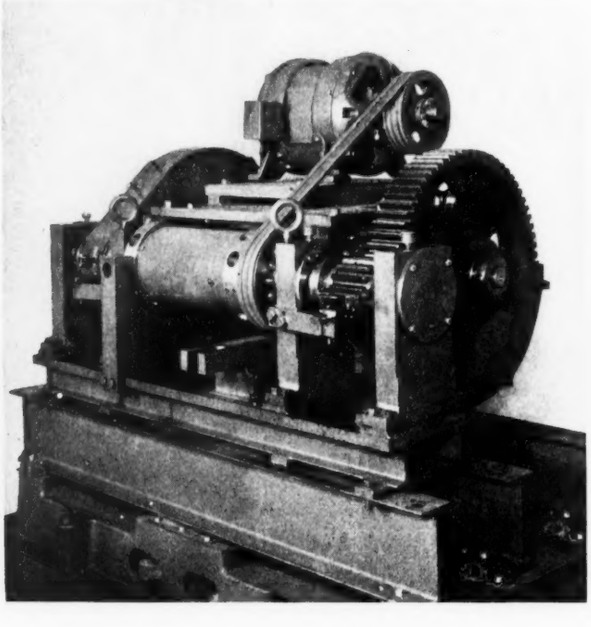
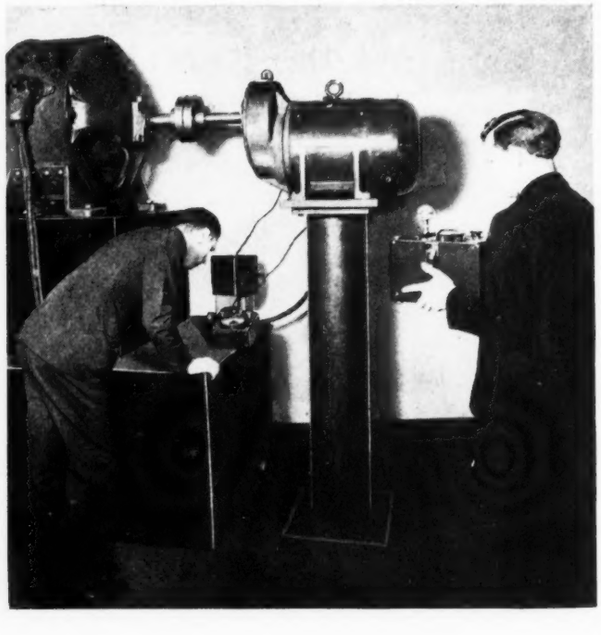


Fig. 14. Testing Gearing for Noise by the Use of Modern Noise Testing Equipment



ening, the hob is inspected, and if found within the preset limits, an approval slip is attached and the hob released for use. The sharpening of the hob is a very important operation, as the spacing and radial symmetry of the teeth must be controlled within very close limits, in order that the hob will cut gears with tooth profiles that are within 0.0002 inch. The sharpening machine has precision-gashed index-plates to control the spacing, and as these plates are considerably larger than the hob, the chance of error is reduced to a minimum.

The care given to the hobbing machines also plays an important part in maintaining precision in the cut gears. Each machine receives at definite intervals a complete inspection which covers the oiling system; condition of the ways and bearings; hob-arbors; indexing worm and wheel; change-gears and studs; feed-screws; and alignment of outboard support with the work-table and the cutter stanchion. These regular inspections are just as important as the setting of the machine and the cutting tool in producing trouble-free precision gearing.

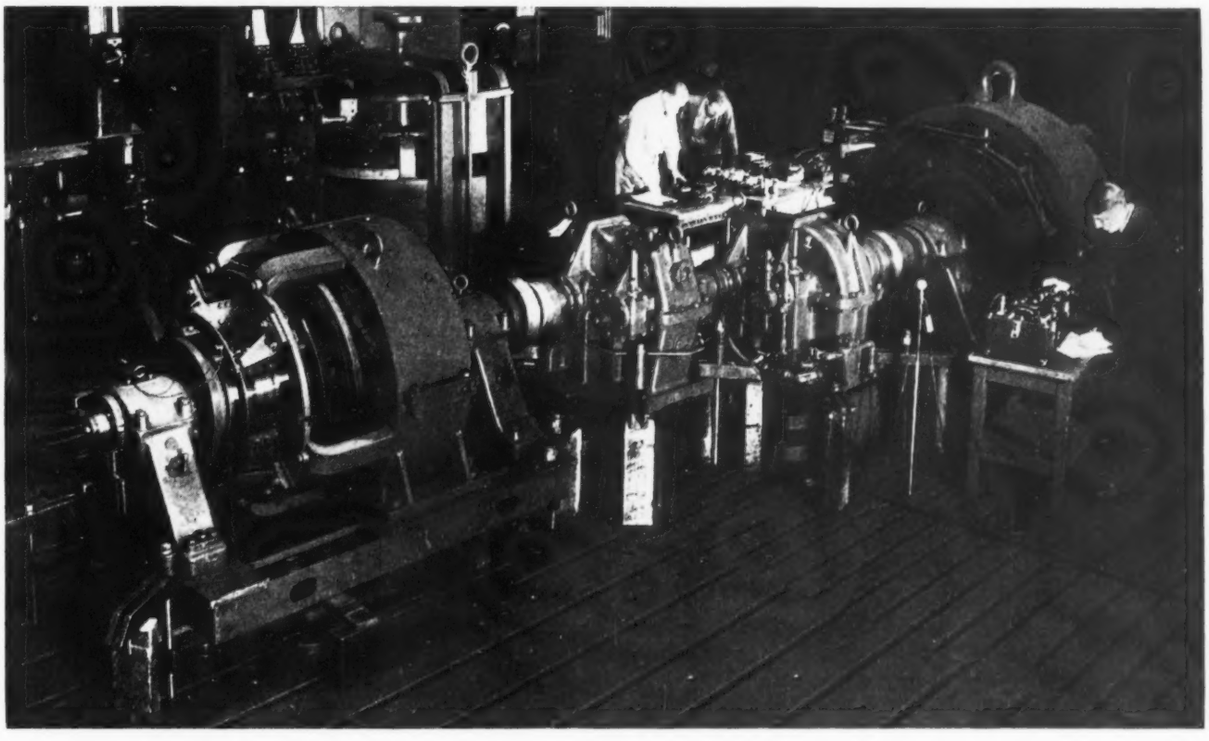


Fig. 15. Arrangement for Making a Complete Test Covering Lubrication, Temperature, Efficiency, and Noise of Gearing under Full Load

Finishing Precision Gears by Shaving

A method of finishing precision gearing which is rapidly coming into use is shaving. This operation consists in removing stock to the extent of 0.002 or 0.003 inch by taking a shaving cut. Two types of machines are used for this purpose—one having a rack type cutter, and the other a circular type cutter. Both of the cutters are serrated, and it is the edges of these serrations that form the cutting edges. The gear to be shaved meshes with the cutter, the axis of which is slightly "crossed," or inclined. It is this "cross" effect that causes the cutter to shave when the gear is rotated in mesh with it. There are no gear trains or lead-screws for rotating the gear, as the gear rolls freely on centers, and the rotation is caused by its being in mesh with the power-driven cutter.

The cutters used are hardened and ground to very close limits (plus or minus 0.0001 inch), and the tooth profile and spacing are controlled solely by the cutter. Gears finished by this method have uniform pitch diameters and base pitch, and show a polished finish. This should not be thought of as a burnished finish, as it is due not to the pressure, but to the fineness of the cut being taken.

At the Nuttall plant, equipment is available for shaving gears up to 17 inches in diameter by 5 inches face, having a total shaft length between centers of 22 inches. The gears that are finished by this process pass through the same operations as all other precision gears, and are finish-hobbed, using a ground-form Class A hob. The shaving operation is performed as an added refinement, which insures better wearing and more quiet gearing than could otherwise be obtained. Gears that exceed the capacity of the shaving machine are

finished by a very fine finishing cut on the hobbing machine.

Shaved gearing is held within limits of 0.0002 inch on tooth form, spacing, and lead. The gears used in the company's gear-motors are finished by this process. As an example of their quietness, in tests made, the noise level at 6 feet has been as low as 62 decibals for a single reduction 10-H.P. unit.

Final Running-In and Testing

One of the most important and difficult problems confronting the manufacturer of gearing is the final testing of the equipment to assure continued trouble-free and satisfactory performance. Fig. 12 shows a machine in which gears that are to be mounted on accurately specified centers are being run-in. The center distances are predetermined by the design engineer, after which a gage-block is made with a dimension equal to the required center distance. This gage-block, which protrudes from the front of the machine and is shown being inserted by the operator in Fig. 12, controls the center distance within 0.001 inch. After the gears have been thus accurately located, they are operated at full speed, and their behavior noted.

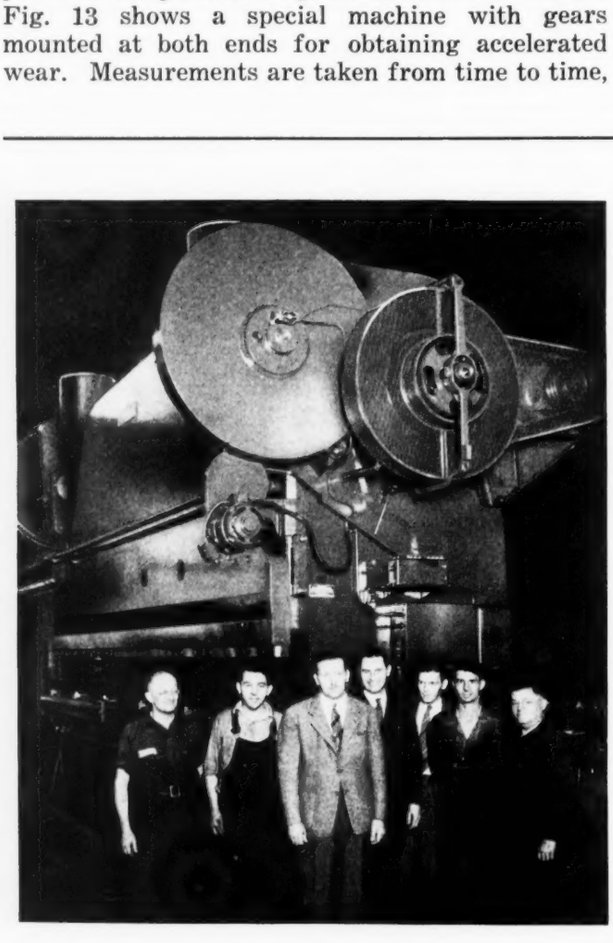
Many tests are being made to determine how gears can be improved. Since long wear is an important factor in almost all types of gears, this phase of the problem is given much consideration. Fig. 13 shows a special machine with gears mounted at both ends for obtaining accelerated wear. Measurements are taken from time to time, and the results obtained from various combinations of materials are observed.

Fig. 15 shows how a complex test of lubrication, temperature, efficiency, and freedom from noise is being carried out under full load. Here a large motor drives the low-speed shaft of a speed increaser, the high-speed shaft of which is coupled to the high-speed shaft of a second speed increaser, which, in turn, acts as a speed reducer for driving the loading generator at its normal speed.

The testing of industrial equipment in general, and gearing in particular, for noise has received much attention during recent years. Fig. 14 shows what is known as a noise-level and load test on a gear-motor which is to be used under conditions where noise must be practically eliminated. All gear-motors for such service are tested on a pedestal like that shown in the illustration, this mounting being similar to that which is employed for the equipment in use.

* * *

Slowly, but inevitably, the experiences of the depression are proving to both labor and capital that in a democracy like ours the employer and the employe have a joint stake. New relationships between capital and labor, between producers and consumers, between business and the people it serves, can be achieved without chaos or national disaster. Once achieved, they will prove the best safeguards against radical movements destructive to the system which built America.—*New York World-Telegram*



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Lockheed Builds Planes for Commerce and Defense

Advanced Manufacturing Practices Followed in the Production of Airplanes of Both Military and Commercial Types—Second of Two Articles

By J. H. SREENAN
Factory Manager
Lockheed Aircraft Corporation
Burbank, Calif.

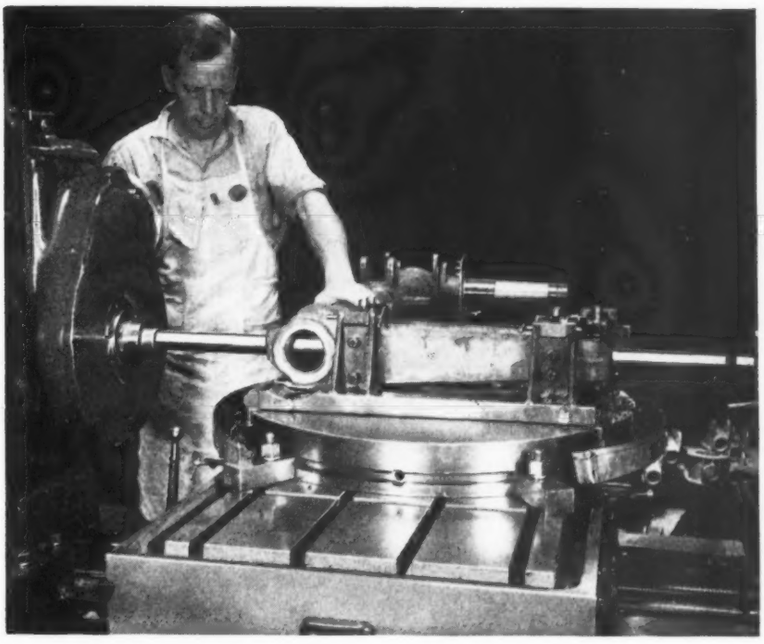


Fig. 13. Welded Landing Gear Fulcrum being Accurately Bored, Faced, and Milled on a Horizontal Boring, Milling, and Drilling Machine

THE latest methods in the forming of sheet-metal parts for airplanes, as well as welding, tube-bending, and physical testing operations on such parts, were described in an article published in July MACHINERY, page 140. The present article shows additional examples of work performed in the machine shop and metal department of the Lockheed Aircraft Corporation, Burbank, Calif.

Recent installations in the machine shop include a battery of nine horizontal Lucas and Universal boring, drilling, and milling machines. These machines eliminate the need of special jigs when a limited number of parts of one kind are scheduled through the shop, because they enable a considerable variety of operations to be performed with a single set-up of the work. A typical operation on a Universal boring mill is shown in Fig. 13. It consisted, first, of boring a hole 3.750 inches in diameter in a welded landing gear fulcrum to provide a tight metal-to-metal fit for an oleo strut. (In this particular case, however, a work-holding fixture is employed.) The hole had to be held to size within plus or minus 0.001 inch. After the hole had been bored, the boss surrounding one end of the hole was faced. In the boring operation, a fly cutter was used to obtain accurate location of the hole, and then a milling cutter made into a reamer was employed to finish the hole.

When this bore was completed, the table of the boring mill was indexed through 90 degrees to bring the work into the position shown. Bores about 8 inches long were then finished at opposite ends of the arm seen in line with the boring spindle, to a diameter of 2 inches within plus or minus 0.001 inch. Cuts were

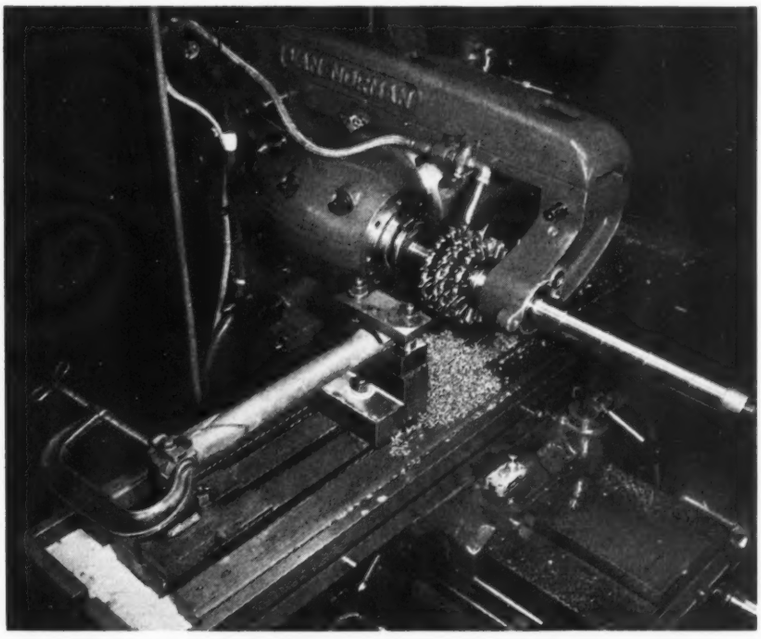


Fig. 14. Yokes on the Opposite Ends of Motor Mount Braces are Milled with the Equipment Here Shown

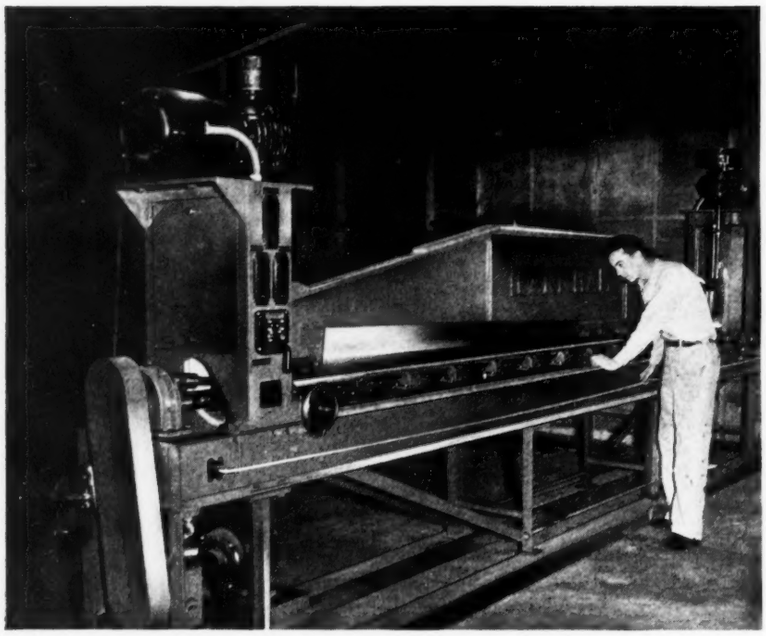


Fig. 15. Bending Roll by Means of which Aluminum-alloy or Stainless-steel Sheets are Bent to Various Radii from End to End of the Sheets

taken simultaneously on the two ends, and the bores had to be in alignment within 20 minutes. After the rough-boring cut, a bore reamer was used for finishing. Various lugs were face-milled on the same part without changing the mounting of the work.

A typical operation performed in the machine shop is that of milling braces for motor mounts on Van Norman milling machines, as illustrated in Fig. 14. Four cutters, 6 inches in diameter, mill the inner and outer faces of the yokes on opposite ends of these braces in two set-ups of the work. The customary tolerance on the width of the yoke slot is plus 0.005 inch, minus nothing, while limits of plus or minus 0.010 inch are specified for the thickness of the yoke lugs. The front end of the brace is held in a V-block, and the yoke in the opposite end is engaged by an upright arm on a welded fixture, fastened to the machine table.

A machine recently installed in the sheet-metal department that facilitates forming the leading edge skin of wings and stabilizers is the Farnham bending roll shown in Fig. 15. This machine is designed especially for forming long pieces of either a straight or tapering nature. For instance, a wing skin or other part can be formed with a rounded contour that changes gradually from a radius of, say, 8 inches at one end to a radius of 3 inches at the other. This is made possible because the cross-beam which supports the long top roll can be adjusted independently at each end in order to obtain any required angle of tilt or height above the two bottom rolls which are in line horizontally with each other. These bottom rolls can be adjusted in and out, as required. The machine handles sheets up to 16 feet long.

Separate power units are furnished at the opposite ends of the machine for raising or lowering the cross-beam, and there are large graduated dials by means of which records can be readily made of different top-roll settings in an operation, so that the operations can be duplicated at any time. There are also dials on the lead-screws that control the in-and-out settings of the bottom rolls.

In a typical operation, the sheet being rolled is run back and forth a number of times through the rolls. The practice is to form the stock on both sides of the bend first to the larger arcs that lead to the curved edge and then to the smaller radii of that edge. Reversal of all rolls is controlled through clutches which are actuated by pulling a rope that extends along both the front and back of the machine. With this arrangement, the operator can control the roll rotation from any point along the machine.

The corrugating of Alclad aluminum-alloy sheets for service as stiffening members in wing and other construction is performed on a Dreis & Krump

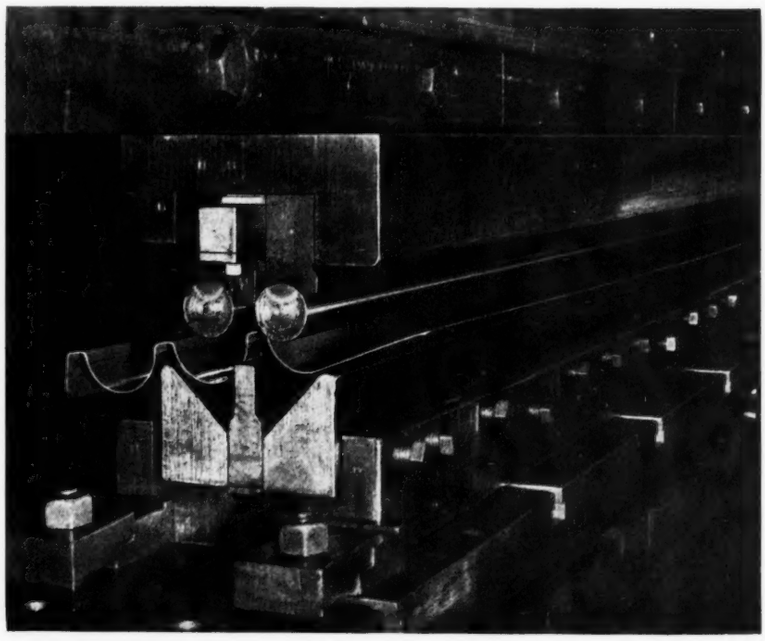


Fig. 16. Punch and Die Employed on a Press Brake for Corrugating Long Sheets of Aluminum Alloy

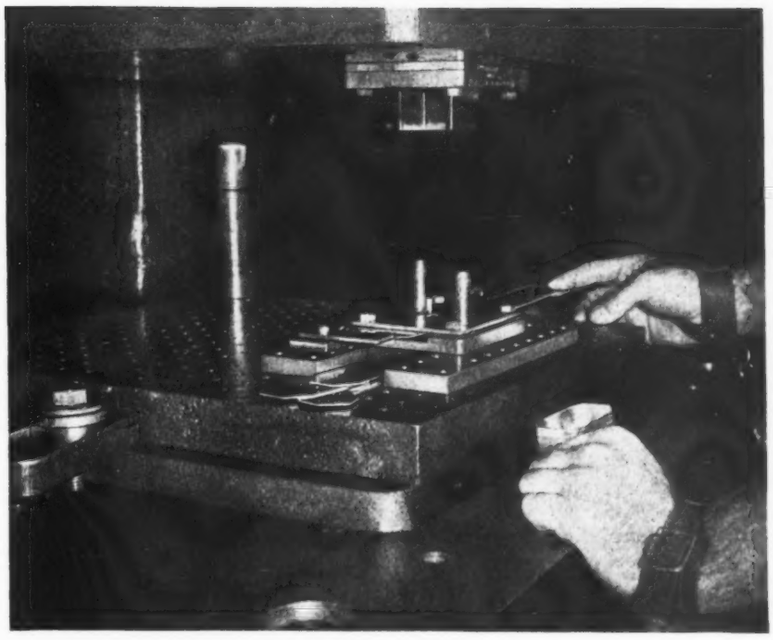


Fig. 17. Producing Simple Blanks with a Die Set in which the Die Consists Merely of a Thin Plate of Casehardened High-carbon Steel

press brake, a close-up view of which is shown in Fig. 16. All sheets to be corrugated are drilled and routed to templets, and are accurately located in the corrugating operation by positioning the drilled locating and rivet holes over small dowel-pins provided along the central die member.

The practice is to move the sheet through the press brake from one row of holes to the next. The two round bars which help to make up the upper die are hard chromium-plated. Before this practice was adopted, these die members had a tendency to pick up chips that marred the corrugated sheets. Also, the bars could not be kept clean and wore undersize rapidly.

Considerable economies have been effected in the press shop by applying the Continental method of blanking small pieces of aluminum alloy and stainless steel from strip stock, Lockheed having obtained a license for the use of this process. A typical application on a Niagara press is shown in Fig. 17. The die consists simply of a thin sheet of casehardened high-carbon steel with an opening of the required outline. In many instances, the punch is also a simple thin plate. Sometimes rubber is used in the die member for ejecting the blanked piece. A variety of sheet-metal pieces are turned up along the edges by the use of the Erco metal-forming machine illustrated in Fig. 18.

New Corrosion-Resistant Coating

An interesting new surface treatment designed to prevent or minimize corrosion of boilers consists simply of applying a coating by means of dipping, brushing, or spraying, which hardens upon exposure to light. The basic constituents of the composition developed and patented by Acheson Colloids Corporation, Port Huron, Mich., are colloidal graphite, an electro-positive metallic filler, a hard-enable organic colloid, and a hardening agent for the colloid, suspended in water. The coating may be applied at normal temperatures, or if faster drying is desired, at around 100 degrees C. After application, exposure to natural or artificial light hardens the organic colloid, forming a corrosion-resistant coating with a relatively high resistance to abrasion.

* * *

Aeronautical Standards Board

The Society of Automotive Engineers announces the formation of the S A E Aeronautical Standards Board for National Defense, with Theodore P. Wright, vice-president in charge of engineering of the Curtiss-Wright Corporation, as chairman. The new board will undertake a cooperative program of development and coordination of aircraft standardization in connection with national defense.

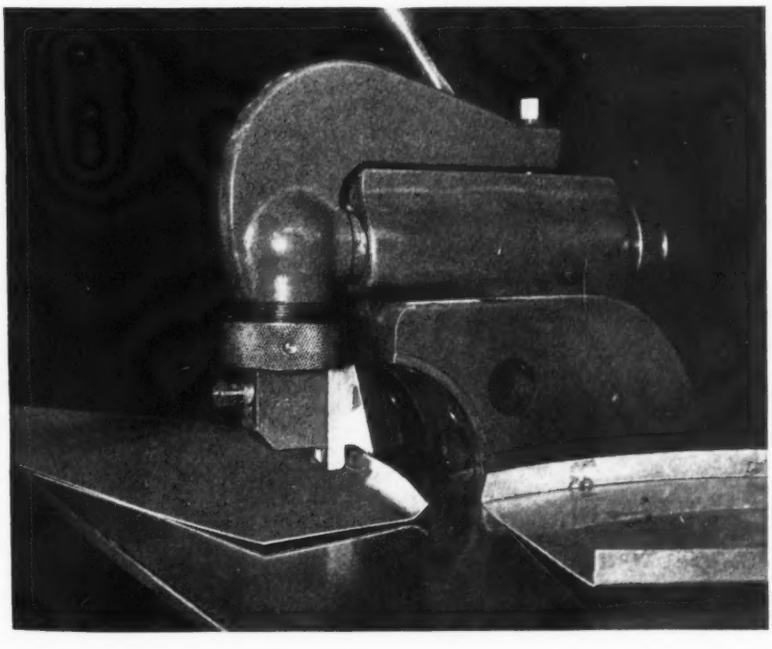


Fig. 18. Metal-forming Machine Used for Bending over the Edges of a Variety of Sheet-metal Parts

Drill Points for Deep-Hole Drilling

By F. O. HOAGLAND, Master Mechanic
Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn.

IN connection with the operation of the machine recently developed by Pratt & Whitney Division Niles-Bement-Pond Co., for sharpening deep-hole drills, which was illustrated and described in July MACHINERY, page 215, interest has been expressed in the best type of drill point to be used on drills for deep holes.

Fig. 1 shows drills that have been ground in accordance with recommended practice. Fig. 2 indicates the angles and other details of the drill point that have been found most advantageous for general use. Dimension *A* should be 1/8 inch for drills about 1/4 inch in diameter; 3/16 inch for drills about 1/2 inch in diameter; and 1/4 inch for drills about 3/4 inch in diameter.

A skilled operator can sharpen a deep-hole drill by hand, but to do so properly has always been considered somewhat of an achievement; now, with the development of the new Pratt & Whitney machine the correct sharpening of deep-hole drills has become a comparatively simple routine matter.

A single-lip deep-hole drill will cut a hole close to the size of the drill, whereas the conventional twist drill is likely to cut over size, since it is difficult to grind the two lips exactly alike. As shown in Fig. 2, the "bevel" *B* on a deep-hole drill should be from one-third to one-half the width of the cutting lip. If the "bevel" is made narrow, there is a tendency for the drill to cut over size; if the "bevel" is very small, the drill will vibrate and literally get out of control.

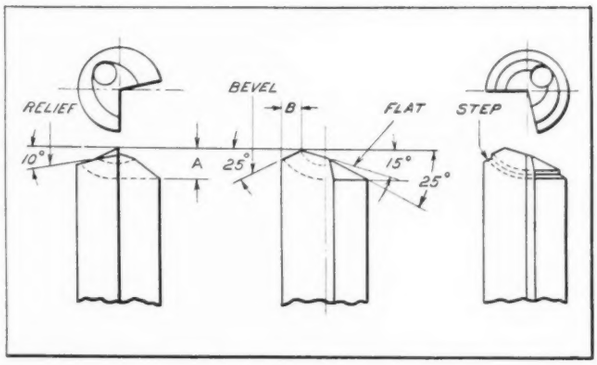


Fig. 2. Angles Used on the Points of Deep-hole Drills for Drilling Medium-hard Steel. For Mild Steel, Increase 20 Per Cent; for Alloy Steels, Decrease 20 Per Cent

The angles suggested are for the average run of work in medium-hard steel. They may be increased by 20 per cent for drilling mild steel, and decreased by the same amount for drilling alloy steels.

In a deep-hole drill, the chip groove is cut to the center of the drill, and it is therefore impracticable to sharpen the drill so that the "bevel" reaches the exact center. On this account, a "flat" having an angle opposite to that of the "bevel" is produced, so as to make sure that the heel of the cutting lip is below the cutting edge. Incidentally, this also provides for a generous passage of oil into the chip groove to lubricate the cutting edge and remove the chips.

The "stepping" of the drill point splits up the chip and facilitates its passage through the chip groove in the shank. It aids in producing smoother holes and increasing the life of the drill between sharpenings. In sharpening by hand, the practice has been to use fairly soft and coarse-grit wheels without a coolant. A fine-grit wheel has seldom or never been used, because, when running dry, it has a tendency to burn the cutting edge of the drill.

The cutting edge of the drill must be as smooth as possible. A fine-grit wheel should be used on the drill sharpening machine for finish-sharpening, or the cutting edge should be honed after being sharpened. The importance of smooth

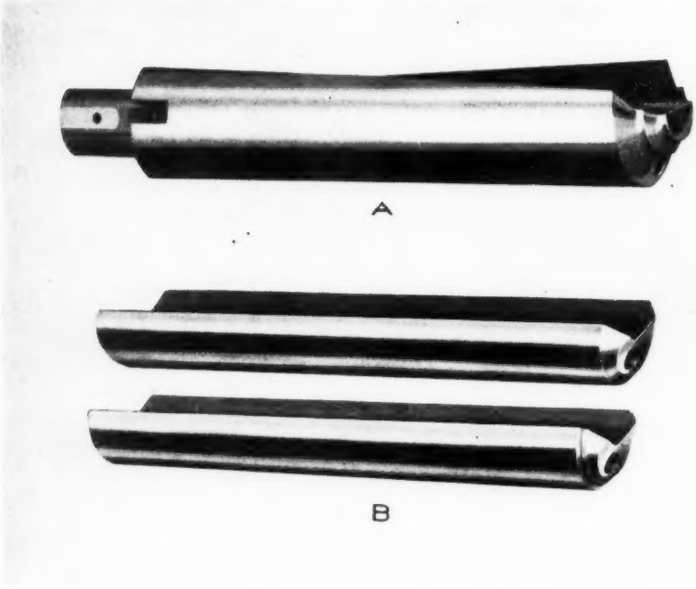


Fig. 1. General Appearance of Drills Properly Ground for Drilling Deep Holes; Drill for Larger Holes is Shown at A, and Two Styles of Grinding for Drills of Smaller Sizes at B

cutting edges has only recently been fully appreciated, although a smooth cutting edge may increase the life between sharpenings as much as 100 per cent. The oil-hole in the drill should always be cleaned out after sharpening.

Small drill tips are welded to their shanks, but on larger sizes of drills, the tips are made detachable, because the long and heavy shanks are cumbersome to handle during the sharpening operation.

Fig. 3 shows the application of the grinding wheels in the Pratt & Whitney machine for the grinding of the "bevel" and "flat" on the drills. The two illustrations at the left indicate the grinding of the "bevel" and its helical relief; those at the right show the grinding of the "flat" and its relief.

So far, we have considered drills for drilling solid metal. At times, however, it becomes necessary to drill long steel tubes having relatively small cored holes. In that case, the drill, if sharpened as shown in Fig. 2, would have a tendency to follow the center of rotation of the work; whereas, if pointed, to let a portion of the "bevel" enter the cored hole, it would tend to follow the hole.

Special conditions are sometimes met with that may require modifications in the sharpening of the drill point. For example, at *A* in Fig. 4 is shown a case where the drill is required to go through two pieces of metal, as in drilling the oil-hole in an automobile engine connecting-rod after the bronze bushing has been inserted. The drill point is shown about to break through the connecting-rod metal, ready to enter the bronze bushing. It is prevented from doing so by the conical-shaped projection representing the last metal in the connecting-rod. This piece of steel is now cut loose, but sticks to the cutting edge of the drill.

Continued feeding of the drill will either crush this piece of steel or break the drill, the condition being similar to that encountered when a heavy steel chip gets under the edge of a twist drill. In such cases, it is necessary to sharpen the drill as indicated at *B* in Fig. 4, so as to eliminate the conical projection. This drill point is not so efficient as the one regularly used; but for a special case like this, it is advisable to use it.

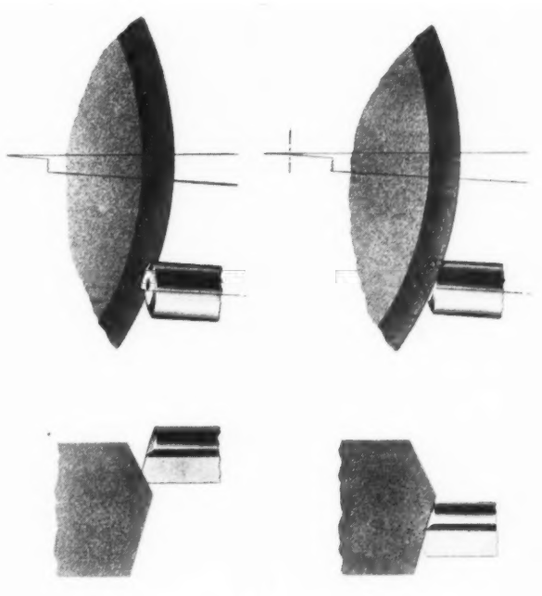


Fig. 3. Application of the Grinding Wheel of the Pratt & Whitney Deep-hole Drill Sharpener to the Grinding of the Bevel and Flat on Deep-hole Drills

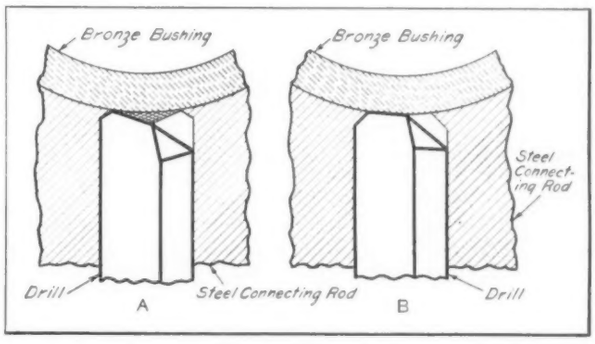


Fig. 4. Diagrams Indicating the Conditions Met with when Drilling an Oil-hole through a Connecting-rod and a Bronze Bushing

* * *

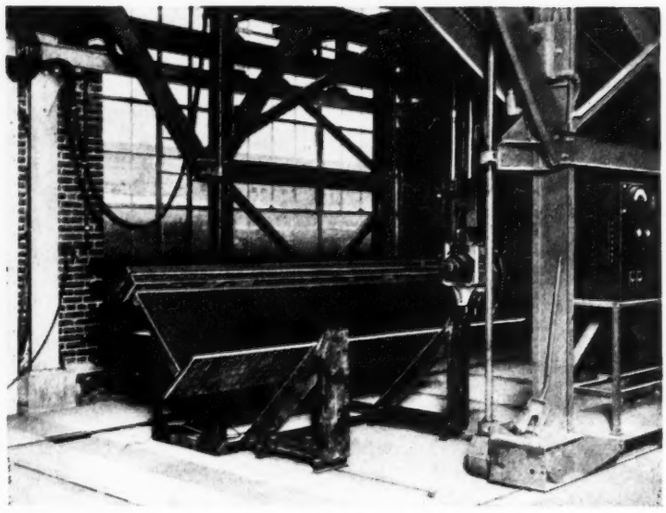
Standardized Line of Carboloy Tools Greatly Reduced in Price

Carboloy Company, Inc., Detroit, Mich., has announced that, due to the expanded manufacturing facilities of its new Detroit plant and the economies resulting from greater production efficiency, Carboloy cutting tools are now available at greatly reduced prices. The new development, which has been under way for the last three years, covers the mass production of a standardized line of Carboloy cutting tools designed to include from 80 to 90 per cent of all applications of cemented-carbide tools. This simplified line of tools comprises five styles in three different grades. It is stated that a typical new standardized tool, for example, will sell, when bought singly, for $1.85, compared with tools previously costing $5.84; if bought in quantities of fifty or more, the cost will be 90 cents apiece.

In this connection, a further price reduction—the sixth since 1929—on cemented-carbide metals has also been announced, which will decrease the price of such Carboloy products as special tools and tool bits, dies, wear-resisting inserts, etc. Coincident with the announcement of price reductions on all dies, the company has also announced that Carboloy round-hole dies for drawing bars and tubing up to 3 1/2 inches in diameter are now available. Improvements in construction have also been made in the larger standard drawing dies.

Flame-Cutting and Welding in the Preparedness Program

By D. E. ROBERTS
The Linde Air Products Co.
New York City

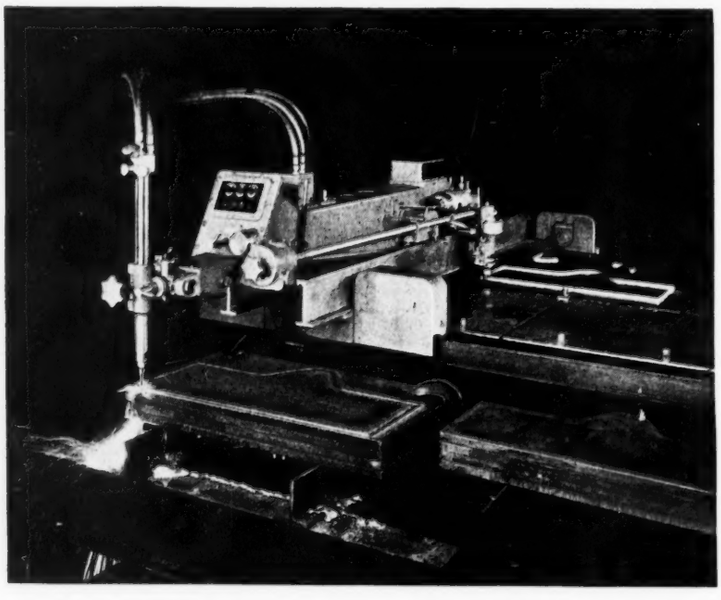


"Unionmelt" Welding as Applied to a Bending-brake Bed. Here a 1-inch Flange is Shown Being Welded to a 2 1/2-inch Web

THE difficulty of building machinery at a sufficient rate of speed to supply all the needs of industry has been said to be one of the bottlenecks in the Preparedness Program. For that reason, it should be emphasized that flame-cutting processes, welding methods, and flame-hardening offer advantages that ought to be considered in the machine-building program. Machine bases, frames, brackets, gears, levers, covers, lubricant and coolant containers and other machinery parts can be flame-cut and welded from standard rolled-steel plate easily obtainable in the market. Great latitude is permitted the designer, and experiments and changes can easily be made. The manufacture of a single machine of highly specialized type is economically possible by these processes.

Machinery manufacturers have at their disposal a full range of oxy-acetylene cutting machines varying in size from small portable equipment to large stationary machines of unusual accuracy, some of which are provided with as many as five blowpipes for multiple cutting. These machines can be set to work at a moment's notice and with a minimum of preparation, since cutting can be performed with only a blueprint as a guide. In the case of intricate shapes or repetitive cutting of the same shape, a templet which guides the tracing wheel of the cutting machine can quickly be made.

Stack-cutting—the procedure of cutting through a stack of plates piled one on top of the other and tightly clamped together—is another important development for producing steel sheets or plates of any size and shape in quantity. By combining this process with multiple cutting, in which a number of blowpipes are used, large quantities of identical parts can be turned out with great rapidity.



Stack-cutting Makes it Possible to Cut to Shape Identical Parts from Plates Piled on Top of One Another

For welding machine bases, in which comparatively thick sections are joined, the new electric welding process known as "Unionmelt" welding offers considerable advantages. This is a fully automatic method of making high-quality welds in one pass, and in any commercially used thickness of steel, as much as twenty times faster than by former methods. For example, high-quality butt-welds can be made at the rate of from 10 to 12 inches per minute in a 1-inch steel plate, and at the rate of from 5 to 6 inches per minute in a 2-inch plate.

Unionmelt welding is an electric

process using the heat generated by the passage of an electric current from the welding rod to the work being welded. The welding action takes place beneath a blanket of highly resistant and conductive granulated material known as "Unionmelt," there being no open visible arc nor sparks, spatter, smoke, or flash. The operator merely pushes buttons or adjusts controls to operate the welding equipment.

Another aid to the efficient production of machinery in general, and machine tools in particular, is offered by the oxy-acetylene flame-hardening method for the selective hardening of wearing surfaces. This process has already been applied to a considerable extent. The ways on lathes, planers, and milling machines can be so hardened, as well as gear teeth and wearing surfaces of valves, bearings, cranks, and crankshafts, etc. All these processes—flame-cutting, welding, and flame-hardening—combine the advantages of speed, economy, and flexibility—advantages that at the present moment are particularly important.

* * *

Machining Aluminum Anti-Aircraft Gun Recoil Mechanism Frame

The heat-treated aluminum casting used as the frame for the recoil mechanism of a caliber 0.50 anti-aircraft gun mount is machined in an Acme universal turret lathe at the Rock Island Arsenal, Rock Island, Ill., as here illustrated. The part is held for this operation on a solid shelf projecting from a fixture that is mounted on the faceplate of the machine. The hole nearest the turret must be machined to 1.750 inches, within limits of plus 0.001 inch minus 0.000 inch, and the hole nearest the faceplate to 1.655 inches within the same limits. The bosses on each side of these holes must also be finished within close limits, the over-all length being held to 8.500 $\pm$ 0.002 inch.

The tool in the first face of the turret is equipped with two cutters for rough-boring both holes at the same time. Upon the completion of this operation, a hook-type cutter on the next turret face rough-machines the inner boss of the front bearing, after which a similar cutter on the next turret face machines the front boss of the rear bearing. In both instances, the turret is fed crosswise after the tool has been fed to the required position. Both holes are next finish-bored with tools on a bar that is piloted in the headstock bushing, after which the holes are simultaneously reamed with a piloted bar seen in the illustration entering the work. Finally, the inner face of the front bearing is finished with a hook tool by applying the cross-feed of the turret.

Classification of Tool Steels According to Usage

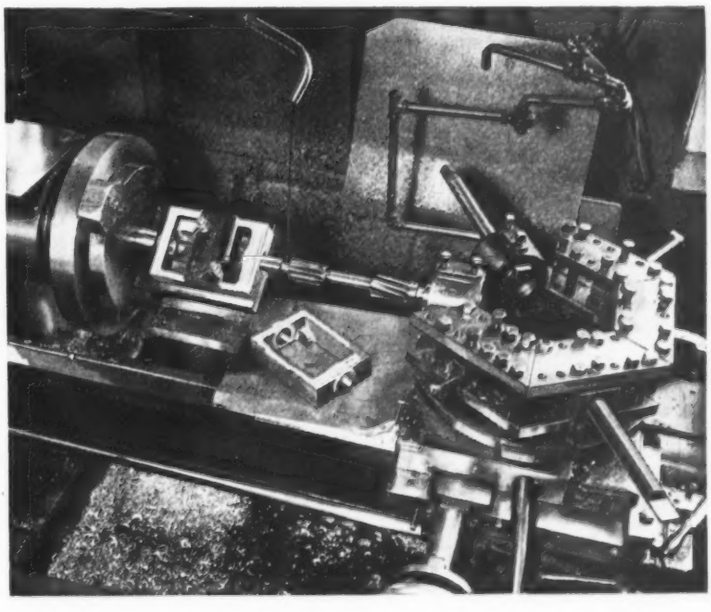
The American Standards Association, 29 W. 39th St., New York City, announces that it has been requested by the American Society of Tool Engineers to undertake a standardization project on the classification of tool steels according to usage. The purpose of this classification is to eliminate guesswork in selecting the proper kind of steel for a specific use. The project is also intended to include other cutting materials, such as carbides and Stellite.

It is stated that there are about one thousand brands of tool steel on the market, of which many are wholly or nearly identical. Since there are no standards by which the qualities of these brands can be judged and classified, the user has no generally applicable guide for selecting the types of steel to use for different purposes, and many times, therefore, he may be using the wrong steel for a particular application. This work of standardization is not one that is easily accomplished, and, obviously, it will require the cooperation of both makers and users of cutting tool materials.

* * *

An Industrial Paint Clinic

A consultation service for the solution of industrial maintenance paint problems under the name of the Industrial Paint Clinic has been organized by the American-Marietta Co., 41 E. Ohio St., Chicago, Ill., manufacturer of paint products. This clinic or laboratory, staffed with experienced chemists and technicians, is equipped to study paint problems that may be submitted by industry.



Reaming Two Holes Simultaneously in a Gun Recoil Mechanism Frame on an Acme Universal Turret Lathe

Engineering News Flashes

The World Over

Improved Method for Cleaning Brass before Nickel- or Chromium-Plating

An improved method for electro-cleaning buffed brass, bronze, and other copper alloys has been developed by Oakite Products, Inc., 22 Thames St., New York City. This method, known as the Oxbrite process, is of especial value as a preparatory operation to plating with bright nickel, chromium, cadmium, or other plating metals.

The new process eliminates the need for a cyanide dip and a copper strike before plating. It makes possible, in addition, bright nickel-plating of soft soldered work without preliminary copper-plating. The method assures freedom from peeling of the electroplated deposits and provides proper adhesion, so that bright, lustrous, uniform deposits are obtained. The process has been successfully used under actual production requirements in a number of plants, and has clearly demonstrated its advantages and economy.

Synthetic Rubber Compounds that are Conductors of Electricity

Compounds of natural rubber and synthetic rubber with a high degree of electrical conductivity have been developed by the B. F. Goodrich Co., Akron, Ohio. Natural rubber, unless specially compounded with synthetic rubber, as is well known, has the highest electrical resistance of any solid material. The fact that the synthetic rubber admixture can create a material having a high degree of electrical conductivity is, therefore, of unusual interest.

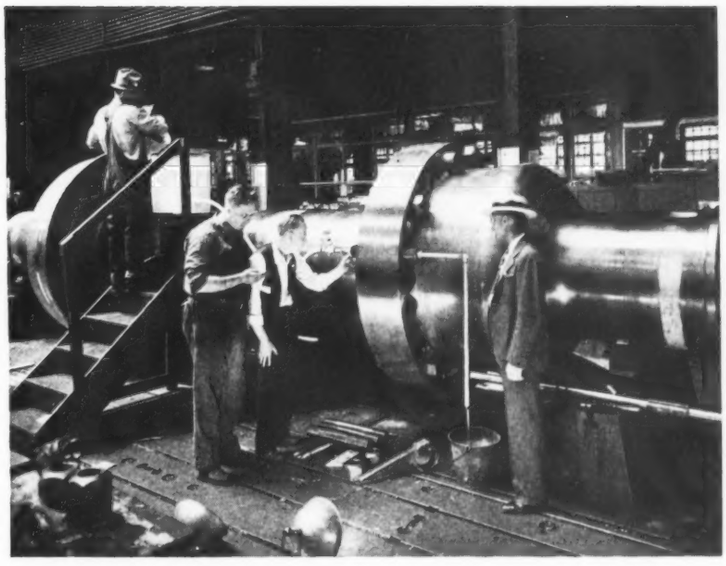
The company is now making solutions of synthetic rubber that can be applied to the surfaces of natural rubber products in the form of a paint which will carry away static. This material has been successfully applied as a belt dressing to carry away static from transmission belts.

Lucite "Piped" Light Now Available for Industrial Use

The peculiar properties of Lucite plastic which enable light to be "piped" to the point where illumination is required, and which have been found so useful in medical work for providing heatless illumination in body cavities, are now being utilized in industry. The new instruments made by the Hitchell Co., Boston, Mass., and the Emeloid Co., Inc., Arlington, N. J., make it possible to illuminate spots inaccessible to flashlights and other conventional lighting equipment.

Lucite actually carries light around corners through rods that are curved so that they will reach into obstructed nooks and cavities. The light

A Giant Surface Plate that is Large Enough to Hold a Complete Automobile is being Used at the Oldsmobile Plant in Determining the Dimensions of the Assembled Frame and Body of a Car. This Surface Plate is Ground so Accurately that the Error in any 8-foot Length is not over 0.004 Inch



Assembling the Huge Coupling Used for Connecting the Water-wheel and the Generator Shafts of One of the Three 30,000-K.V.A. Generators Built at the Milwaukee Works of the Allis-Chalmers Mfg. Co. for the Chickamauga Dam. The Illustration Shows the Method Used in Shrinking the Tight-fitting 4-inch Bolts in Order to Remove Them from Their Accurately Reamed Bolt Holes. Alcohol Cooled by Dry Ice to 40 Degrees F. below Zero, is being Circulated through a Hole in the Center of One of These Bolts

is originated in the handle, where a metal base holds a small standard type flash battery. Interchangeable rods of three different shapes are available. Although the instrument looks as though it were made of fine crystal glass, it is non-shattering and can be used safely around machine shops.

Streamline Railroad Trains Prove Good Revenue Earners

According to figures collected by the Edward G. Budd Mfg. Co. from various railroads, the new light-weight streamline trains that have been introduced during recent years have proved to be substantial revenue earners. The gross revenue for one year from the Denver Zephyrs of the Burlington Lines, for example, was $2,077,444, while the net earnings were $1,530,155. For all the trains built by the Budd company, the average ratio of net earnings to gross revenues was 61.3 per cent during the same period.

An Electric Annealing Operation that Saved 25 Per Cent of the Cost

A saving of 25 per cent in the cost of annealing forged-steel unions has been made by the Rockwood Sprinkler Co. in its plant at Worcester, Mass., through the installation of a Westinghouse continuous electric furnace equipped with atmospheric control. A stronger and more uniform product has been obtained as a result of the closer temperature control possible.

The unions, ranging from 1/8- to 3-inch pipe size, must be annealed after each of the forging operations, in order to remove stresses set up by cold-working. They were previously batch-annealed in oil-burning furnaces having no atmospheric control. The quality of different unions in the same batch, as determined by Olson pull tests, varied as much as 9 per cent.

The electric furnace recently installed is a 90-K.W. unit, approximately 50 feet long. By burning city gas and air in a combustion chamber and feeding the products of combustion into the annealing chamber, atmospheric control is obtained. The material to be annealed is loaded into trays having a maximum capacity of about 250 pounds each. These are moved through the three temperature zones of the furnace by a hydraulic pusher, actuated by an electric motor. The furnace control system includes an automatic shut-off in case of gas or power failure.

The accurate temperature control has reduced variations in the same batch to as little as 0.4 per cent on 1 1/4-inch unions. Furthermore, the use of atmospheric control has eliminated the pickling operation formerly necessary. Lower unit power costs have been realized with the new furnaces; figured on a fifteen-year amortization basis for the equipment, the saving made amounts to about 25 per cent.

Mammoth Vulcanizer for Rubber-Lining Industrial Equipment

One of the largest vulcanizers ever built, measuring 15 feet in diameter and resembling a huge tunnel when open, has been installed at the plant of the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., at Passaic, N. J. It will be used for vulcanizing rubber-lined tanks and other equipment that must resist the action of corrosive liquids or that must provide protection against contamination of the processed substances. This vulcanizer will make it possible to handle practically any piece of equipment that can be shipped by rail.

EDITORIAL COMMENT

An Industry That Is Ready for the Defense Program

It has frequently been stated that the machine tool industry is the bottleneck of the Preparedness Program. However, no evidence has been brought forth to prove the statement; as a matter of fact, the evidence is all on the other side. The machine tool industry, during the past year, has made a remarkable record for itself, showing that it has the ability, the facilities, and the will to meet the demands placed upon it by National Defense requirements. The production and shipments of machine tools in September, this year, were approximately double the output and shipments of September a year ago. All machine tool plants have expanded their productive capacity by the installation of additional machine tool equipment, by materially increasing their working forces, and by operating their plants in two and three shifts. In addition, about fifty of the companies engaged in machine tool manufacture have increased their capacity by adding new buildings to their present plants and equipping them for increased production.

This is the kind of cooperation that the Government of this country can expect from industry. It is time that industry should tell its story, and tell it definitely and clearly.

Impartial Testing of Shop Tools and Equipment

The value of many tests made on commercial engineering equipment is impaired by the fact that they are frequently carried out by someone who, in the very nature of things, cannot be wholly impartial; for good reasons, he wishes the tests to show certain results. This type of partiality is not peculiar to our times. About two hundred years ago, Alexander Pope wrote:

"To observations which ourselves we make,
We grow more partial, for the observer's sake."

We deal here with a perfectly natural human weakness. Suppose that a research man is employed to conduct tests for a corporation manufacturing certain equipment. He knows that it would be to the advantage of his employer if the results of the tests were favorable. In fact, the research man, himself, may have had something to do with the development of the new equipment. Is it not going to be a little difficult for him to be wholly impartial, and should he be criticized too severely if his findings lean toward the favorable side?

The position of the man carrying out the tests is somewhat similar to the "expert" on the witness stand. Has anyone heard of an expert on the stand who expressed beliefs or opinions that were harmful to the man employing him as an expert? Is it just a coincidence that when experts are employed on both sides of a case in court, each expert generally expresses an opinion favorable to the side that employs him?

The above parallel is drawn simply to emphasize the fact that engineering tests should be performed by wholly impartial agencies who have no commercial interest in the findings, but are simply engaged in ferreting out the facts. Some of our universities are in a position to make such tests. There are also manufacturing companies who have carried out their own tests with complete impartiality. This was accomplished as follows: In testing small tools, for example, the man performing the tests had no way of knowing who were the manufacturers of the various tools tested; the tools were all bought in the open market, and all identifying marks ground off, a number being stamped on each, the significance of which was known only to the manager. When it is possible to carry out tests in this manner, they become truly dependable.

How Industry Makes Social Security Possible

During the last four years, the Westinghouse Electric & Mfg. Co. has paid a total of $9,932,298 in taxes for the benefit of employes under the Social Security Act and under various state unemployment compensation laws. In 1939, these tax payments amounted to $3,125,266—almost three times what they were in 1936. This is the equivalent of $71 a year per employe, and according to laws already passed, these taxes are scheduled to increase by a considerable amount. Obviously, the only way in which industry can carry these heavy tax burdens is by cost reductions through the use of improved machinery, or by raising prices.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Tapering and Trimming Mechanism

By FRANK HARTLEY

A rather unusual mechanism designed to take up very little space while performing several preliminary operations in a complete automatic machine is shown in Fig. 1. Its purpose is to smooth and trim the end of tubular-shaped parts, such as the one shown in Fig. 2. This tube, or cigar, is made of fibrous material with an outer covering that is wound spirally and twisted smoothly over the outside of the fibers while being tapered and trimmed at the end.

The cigar is revolved slowly, but stops temporarily while the trimming device is advanced by a slide mechanism until it is over the tapered end *x*. In this position, the flanged wing portion *H*, Fig. 1, otherwise known as a truing and smoothing plate, centers the tapered end of the tube, the wrapper over the end being drawn flat by this operation.

Cutter *A* is carried by head *B*, the details of this device being shown by the longitudinal cross-section in the lower left-hand corner of the illustration. Rod *C* carries head *B* and, in turn, is mounted in a hollow shaft *D* in which it slides and is rotated for the purpose of smoothing the wrapper on the work. The cross-slots *E* act as trimmers for the surplus shredded fiber and the ends of the wrapping material which have entered the slots as the head is advanced.

Straddling the head or central mechanism just described are two arms *F* having flared ends *H* formed of sheet metal and arranged to pivot at *G* over the sides of the head mounted on rod *C*. The ends of the arms at *H* function as curved ironing members, being pressed together by springs *N*. Yoke members *J* support the outer ends of the pivoted spring pins *P*, thereby pressing arms *F* inward.

Rod *C* has a sleeve *D* attached to it by means of a small pin *Q* which is free to travel longitudinally in the elongated slot *R* of the sleeve. There is also a sleeve at *S*, which is pinned to sleeve *D* at *T*, while a spring *V* between the two sleeves functions so that the entire smoothing and cutting device is free to yield longitudinally to accommodate, within a limited range, varying lengths of tapers on the fibrous tube. Two collars *W* keep the entire unit in position in the bearing bracket *Z*.

The action of the device is as follows: With the tubular work motionless, the device advances over the work, the flared ends *H* guiding the fibrous end

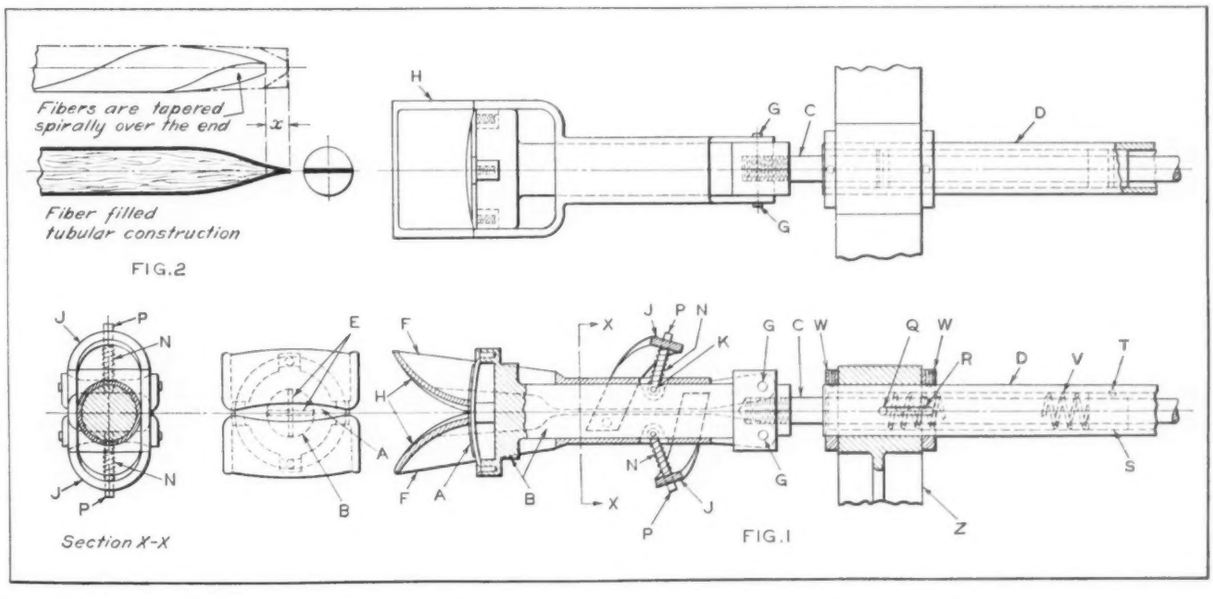


Fig. 1. Mechanism for Tapering and Trimming Tubular-shaped Articles Such as Shown in Fig. 2
Fig. 2. Cigar End Tapered, Formed, and Cut off by Device Shown in Fig. 1

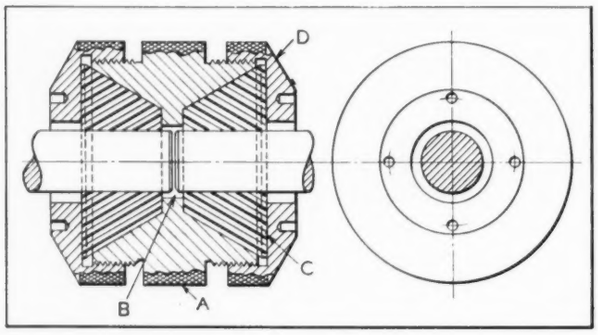
of the work into position so that it enters slots *E* in the cutter. The smoothing device revolves slowly at this time, the spring construction of the arms allowing them to yield and center the work, which is then caused to revolve. The wrapper is thus drawn tight and the surplus end is cut off by the revolving action. As the smoothing device is slowly drawn back off the end of the work, it forms a smooth spirally tapered end. The fact that cutter *A* is mounted on a recessed and cut-away portion of the head makes it possible for the surplus wrapping material cut from the work to fall out of the recess directly behind the cutter.

* * *

Flexible Coupling for Light and Medium Drives

By JOHN A. HONEGGER

The flexible coupling here illustrated was employed by the writer on some 1/2- and 3/4-H.P. drives. Compactness and good dynamic balance are features of the design. The taper form of



Flexible Coupling which Grips Shafts by the Compression of Rubber Rings C

member *A* and flexible rubber rings *C* subjects the latter members to sufficient compression to give the required torque before slippage occurs.

Central member *A* is taper-bored at each end and threaded externally, a communicating hole being provided in the central web at *B*. Into this housing are assembled the two taper or cone-molded rubber rings *C*, in which the two shafts to be connected are inserted. When clamp caps *D* are tightened, the rubber in the cones *C* is compressed around the shafts, thus gripping them with the desired pressure. The gripping power on the shafts can be varied by changing the angle of the cones or the leads of the threads of the clamp caps.

* * *

Armaments alone do not insure victory; numbers of soldiers may be of no avail. France had both. But unity of purpose, character, and willingness to work and sacrifice decide the issue.

The Keystone in the National Defense Program

In a booklet recently published by the Farrel-Birmingham Co., Inc., Ansonia, Conn., entitled "The Great Reliance for National Defense," the fact that national defense rests strongly upon the machinery-producing industries is emphasized. It is pointed out that the total available labor supply in the United States is slightly less than that of Germany and Italy combined, while the nations now controlled by Germany furnish, in addition, an available labor supply approximately equal to that of the United States.

Hence, it is obvious that unless our per capita productivity is enormously greater, the workers of the Axis powers employed at 50 and 60 hours per week, as compared with our workers employed at much shorter hours, represent an overwhelming advantage. In terms of man-hours per week, Germany and Italy alone (not counting the conquered nations) command some 2,750,000,000 man-hours, as compared to 1,800,000,000 for the United States.

The only factor that compensates for our relative inferiority in man-hours is the tremendous productivity per man-hour that is possible in our highly mechanized industries. Available figures indicate that the horsepower utilized in our industries is twice per capita that used in the industries of Germany and Italy. Efficient machinery serves to partially compensate for our inferiority in labor supply and total man-hours. Furthermore, our machinery-producing industries can doubtless expand at a much faster rate than those of the Axis powers. It is these machinery-producing industries, as distinguished from the machinery-using industries that do the actual manufacturing of military and naval equipment, that are our great reliance for national defense."

* * *

Industrial Machinery Exports

The United States exports of industrial machinery in July were valued at $31,094,000, according to the Machinery Division of the Department of Commerce, Washington, D. C. This represented a decline, as compared with the preceding months, caused by the discontinuance of shipments of metal-working machinery to France. The July shipments of power-driven metal-working machinery totalled $14,906,000, a 20 per cent decline from the June total. Shipments of metal-working machinery other than power-driven—including what is generally known as small tools—were valued at $582,000 in July, only a slight decline from the June figure. Exports of power-generating machinery amounted to $1,522,951, or 28 per cent below the June figure. Textile, sewing, and shoe machinery shipped in July was valued at $1,512,858, almost 30 per cent less than the value of similar shipments in June.

Synthetic Rubber Belts

As a result of extensive research, methods were developed a number of years ago for making belts of cotton and rubber, using woven cotton fabric or cotton cords (or both) as the driving member of the belt and rubber as the bonding and insulating element. A method was found for accurately prestretching the duck or cord plies, and special rubber compounds were developed which bonded the plies together and insulated them from each other to prevent shearing. Still other rubber compounds were developed for the belt surface which gave a high coefficient of friction to prevent slipping on pulleys, reducing—and in some cases eliminating —the need for belt dressing.

These belts, however, had the drawback that the rubber was easily destroyed by oil and grease. This limited the use of rubber belts in machine shops and metal-working plants, even though the other characteristics of the drives were favorable. The cutting and lubricating oils used in plants of this type almost invariably caused the rubber belts to soften and swell. The plies separated and the belts became unusable.

According to the Hewitt Rubber Corporation, Buffalo, N. Y., with the recent development of oilproof synthetic rubber, a solution to this problem seemed possible. But synthetic rubber alone was not the answer. Some synthetic rubbers are oilproof, but they do not possess sufficient tensile strength. Others are oilproof and high in tensile strength, but of poor bonding or adhesive qualities. Through exhaustive research, synthetic rubber compounds were finally produced combining oilproof qualities with high tensile strength.

With these developments, an entirely new field has been opened to the use of "rubber" belts. Since their life is no longer affected by oil or grease, the advantages of flat rubber belt drives can now be utilized to the fullest extent. Synthetic rubber transmission belts are available in endless or roll form in any weight, and in styles suitable for high-speed, small-pulley, short-center drives, as well as for heavy, powerful drives.

* * *

Corrosion Resistance of Nickel-Copper Steels

Results of corrosion tests on low-alloy sheet steels containing nickel and copper show that the weathering resistance of steel increases with the nickel content and also with the addition of copper. According to N. B. Pilling and W. A. Wesley, director and assistant director, respectively, of the Bayonne, N. J., Research Laboratory of the International Nickel Co., the superiority of nickel-copper steels is particularly pronounced in a marine atmosphere. Tests have shown that nickel-copper steels containing more than 2 per cent alloy outlasted straight copper steels two or three times at the end of six years' weathering. Results of tests on open-hearth steels used on the droppers and bottoms of railroad coal cars showed a 2 to 1 superiority for nickel-copper steels over unalloyed or copper steels after six years' service. The effects of manganese, silicon, and carbon do not appear to be important, but the presence of a moderate amount of phosphorus seems to improve nickel-copper steels.

In Turning a Steel Casting for a General Electric Rotor Spider Hub, 612 Pounds of Chips were Removed in an Hour by Two Single-point Carboloy-tipped Tools. The Cost of Metal Removal was 1/2 Cent per Pound of Chips, Including Tool and Labor Costs. Depth of Cut, 3/4 Inch; Feed, 1/16 Inch per Revolution

Making Ring-Weights for Balancing Radial Aircraft Engine Crankshafts

Solving an Unusual and Difficult Problem Involving Extreme Accuracy in Obtaining Correct Weight, Center of Gravity, and Balance of Ring-Weights Used in the Balancing of Aircraft Engine Crankshafts

By WERNER I. SENGER, Chief Development Engineer
Gisholt Machine Co., Madison, Wis.

WHEN one- or two-throw radial crankshafts are being balanced, it is necessary to attach a ring-weight to each of the crankpins. These ring-weights are sometimes called "master" weights or "bob" weights, and serve to give a mass effect on the crankpin equal to the average radial force applied to the crankshaft by the inertia effect of master rod, articulated rods, wrist-pins, and pistons in the final motor assembly. As it is general practice to bring the pistons to a predetermined weight and also to bring each end of the connecting-rod to a predetermined weight, it is a perfectly straightforward matter to determine the radial effect of the inertia forces on the crankpin produced by these parts, and it is equally possible to make an exact determination of the total weight of a ring which should be attached to the crankpin during the balancing operation to give an equivalent radial force.

With the application of a Gisholt Type U Dynetric balancing machine to the balancing of radial aircraft engine crankshafts (see Fig. 1), a means was provided for obtaining extremely accurate balancing of these parts. The sensitivity of the machine made it necessary that great care be exercised in the manufacture of the ring-weight which was to be attached to the crankpin during the balancing operation.

In using the Dynetric balancing machine, it was found that, even though the ring-weights were

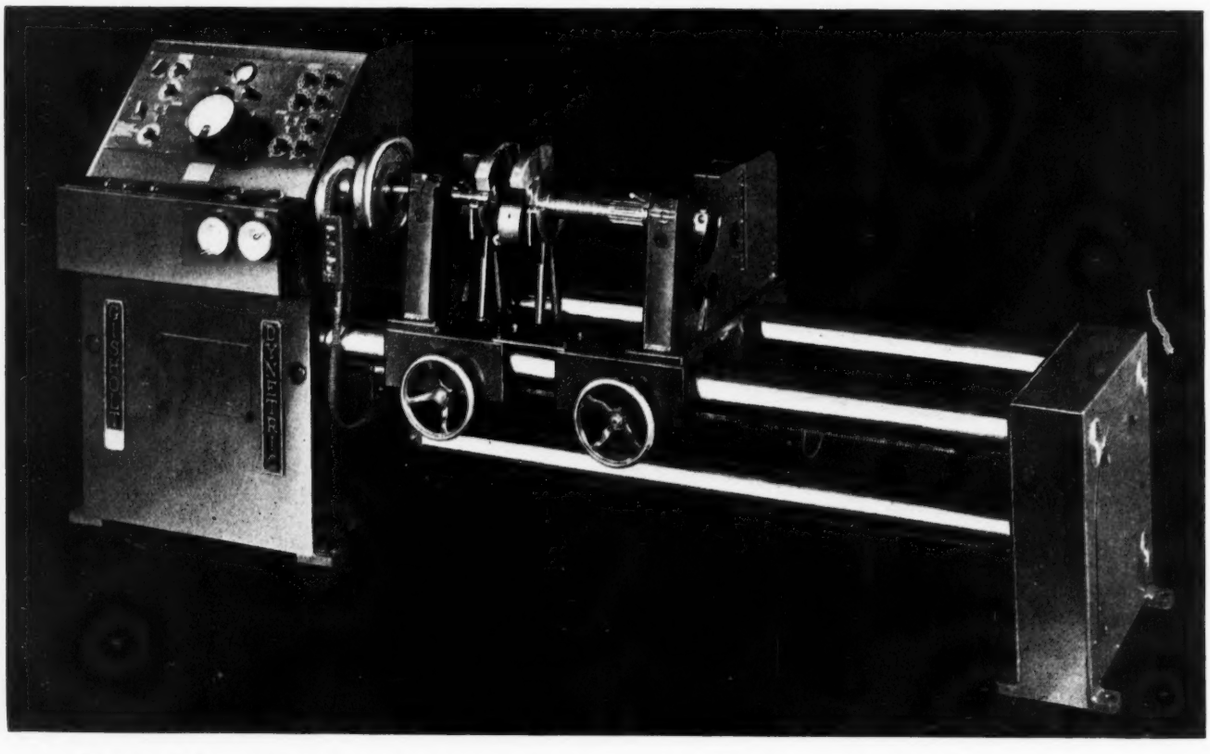


Fig. 1. Balancing Radial Aircraft Engine Crankshafts on a Gisholt Type U Dynetric Balancing Machine

turned, bored, and faced to a high degree of accuracy, the center of gravity of the ring-weight was actually removed from the axis of the crankpin by a considerable amount, due to the fact that the alloy steel used in the weight was not homogeneous. The balancing machine showed this deviation of the center of gravity from the axis of the crankpin by indicating differences in amount and angular location of unbalance in the crankshaft for varying angular locations of the ring-weight. To eliminate this difficulty, it was obviously necessary that the ring-weight be accurately balanced both statically and dynamically, so that, regardless of the angular location of the ring-weight on the crankpin, the readings of unbalance could be duplicated.

It was further found that by moving the ring-weight along the crankpin axis as little as 0.001 inch, there were appreciable variations in the readings of unbalance. When we consider that a ring-weight may weigh as much as 72 pounds and may be attached to a crankpin having a throw of 3 3/8 inches, it is obvious that this axial movement (of only 0.001 inch) of the ring-weight will result in the introduction of an unbalance of 3.858 ounce-inch-inches. From this fact, it became evident that the transverse plane containing the center of gravity of the ring-weights should actually be the transverse plane containing the center of gravity of the assembly of rods and pistons, and that, where more than one weight of a given size might be used for measuring and checking the same crankshaft, the plane containing the transverse center of gravity must be accurately held with respect to a locating face on the ring-weight to produce repeatable results.

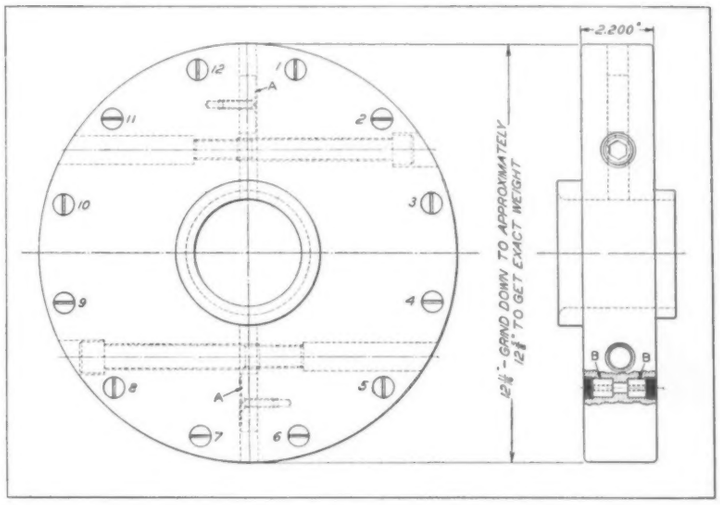


Fig. 2. Design of Ring-weight of Extreme Accuracy in Weight and Balance, Used in the Balancing of Aircraft Engine Crankshafts

Severe Ring-Weight Requirements

It was also found that if a crankshaft were balanced with one ring-weight having a certain total weight, and the shaft were checked with another ring-weight of supposedly equal weight, there were differences in readings of unbalance. This variation was due to the fact that the common practice had been to hold these weights to a total permissible tolerance of 0.010 pound (plus or minus 0.005 pound), and if two ring-weights differed by this amount and were attached to a crankpin having a 3 3/8-inch throw, a static unbalance of 0.54 ounce-inch would be introduced. From the information obtained in the balancing of radial aircraft motor crankshafts on the Dynetric balancing machine, it became obvious that if the potential accuracy of the balancing machine were to be used to obtain the best possible balance of a crankshaft, there would be three requirements that the ring-weight would have to fulfill:

1. The total weight of the ring should be maintained to its computed value within 0.001 pound (plus or minus 0.0005 pound).
2. The transverse plane containing the center of gravity of the ring-weight should be held with respect to the locating face of the ring-weight within 0.00025 inch, and the ring-weight should be so designed as to prevent the axial shift of one-half of the ring-weight with respect to the other half when mounted on the crankpin.
3. The ring-weight should be in static balance to less than 0.125 ounce-inch, and should be in dynamic balance to within 0.625 ounce-inch-inches.

Problems of Manufacturing Extremely Accurate Ring-Weights

The design and production of a ring-weight to meet these specifications might appear to be impossible to accomplish, because if the total weight is maintained to the desired accuracy, metal may neither be added nor removed to control the transverse center of gravity or to arrive at a condition of static and dynamic unbalance. However, the requirements outlined are essential if the variations in unbalance readings, using several different ring-weights one after the other, or using the same ring-weights turned to different angular locations, are to be within 0.25 ounce-inch in each of the planes of correction in the crankshaft.

Fig. 2 shows a design of ring-weight by means of which it is possible to meet the requirements of the specifications. The ring-weight is made of a 0.70 per cent carbon chrome-nickel-molybdenum oil-hardening alloy steel, heat-treated to a Rockwell hardness of from 60 to 62 C. The two halves of the ring-weight are restrained from axial movement with respect to each other by means of the hardened and ground keys *A*. The two halves of the ring-weight are held together on the crankpin

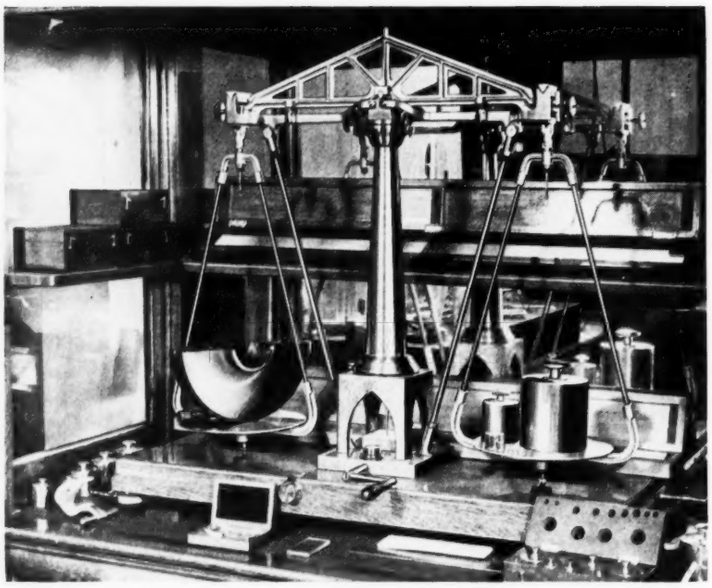


Fig. 3. Equipment that Determines the Total Weight of a 50-pound Ring-weight within Plus or Minus 0.0005 Pound

by means of two different diameter screws, so that even these holding screws may always be expected to come back to exactly the position in which they were originally when the ring-weight was checked for balance, center of gravity, and total weight. The weight of each of the screws is recorded, so that in case one is lost or damaged, it can be easily replaced without destroying the accuracy of the ring-weight.

To provide a means whereby the total weight, transverse center of gravity, and balance can be varied within reasonable limits, the plugs *B* are provided. There are twelve of these plugs on each face of the ring-weight, and they are held in place by means of headless set-screws. All the plugs are made exactly the same length, and the headless screws that hold them in place are ground flush with the face of the ring-weights in order to keep all surfaces smooth, so that there can be no accumulation of dirt which might destroy the accuracy of the weights. The ring-weights were originally made up with the plugs *B* made of steel. Other plugs were made of aluminum, brass, and lead, all having the same outside diameter and length.

Fig. 3 shows the equal balance scales and weights used for determining the total weight of the ring. These particular scales have a capacity of 50 pounds in either pan and a guaranteed sensibility of 1 grain, or one seven-thousandth of a pound (0.000142 pound) at full load. The series of standard weights used in this weighing process were carefully checked by the Bureau of Weights and Measures of the Department of Agriculture of the state of Wisconsin, and are guaranteed to be accurate to extremely small tolerances. The accuracy of the scales was also checked and passed upon by the same department, whose equipment is checked with the Weights and Measures Department of the Bureau of Standards in Washington, D. C., at frequent intervals.

Now, if the correct total weight is once obtained, the location of the transverse center of gravity with respect to the locating face can be varied without changing the total weight of the ring by simply substituting lead plugs for the steel ones on one face and aluminum plugs for the steel ones on the other face. Obviously, if the total weights are to be maintained correct, the weight added to one face must exactly equal that removed from the other face.

Method of Obtaining Static Balance in Ring-Weights

In a similar manner, both static and dynamic balance of the ring-weights are obtained. For example, if the ring-weight requires metal to be removed at No. 1 plug to give balance, only half of the indicated amount of metal is removed from plug No. 1. The other half of the balancing correction is made by adding to the weight of plug No. 7, which is diametrically opposite plug No. 1. In manufacturing these ring-weights, they were first finished to computed dimensions. These dimensions provided for 0.005 inch to be removed from the locating face to provide a rough control for the location of the transverse center of gravity.

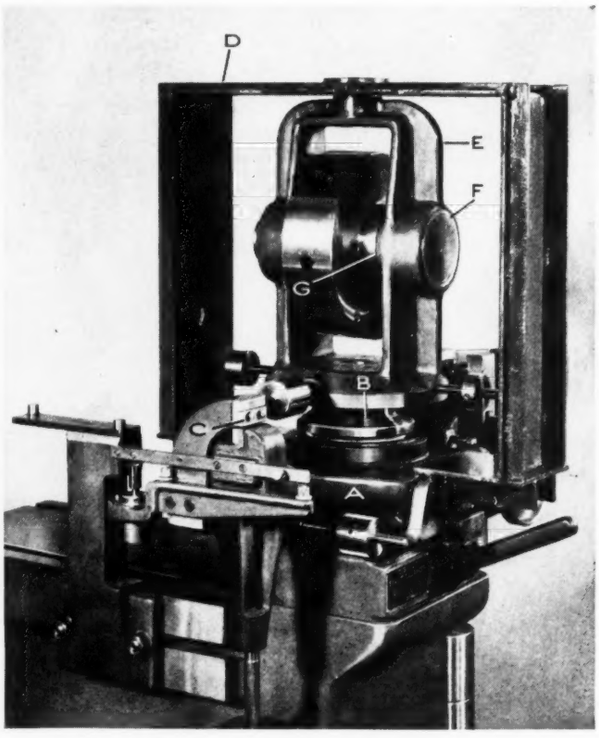


Fig. 4. Fixture Mounted on a Gisholt Static Balancing Machine, by which the Center of Gravity of the Ring-weight can be Located within an Accuracy of 0.00025 Inch

They also allowed approximately 1/2 pound of excess weight.

After the parts had been processed through the machine shop, the total weight was checked and metal was removed from the outside diameter of the ring-weight to bring the total weight to plus 0.005 and minus 0.000 pound. The distance from the locating face to the transverse center of gravity was then determined, and the locating face was ground off as required, so that this distance was within plus 0.001 to plus 0.0005 inch of the desired value. Then all further corrections for weight, location of transverse center of gravity, and dynamic balance were made by changing the plugs as previously described.

Fig. 4 shows a fixture mounted on a Gisholt static balancing machine, by means of which it is possible to determine the distance from the locating face of the ring-weight to the transverse center of gravity. The table *A* of the machine carries a vertical spindle *B*, which can be turned by hand to any desired angular position. The table *A* is suspended from pivots *C* and supports a fixture *D* which carries, at its uppermost point, a bearing that is an exact continuation of spindle *B*. Attached to the spindle and supported at its uppermost point in the fixture *D* is a fixture *E* which has a face *G* an exact distance from the vertical axis of the spindle *B*. The ring-weights are mounted on a horizontal stud *F* having the same diameter as the crankpin, and are located against the face *G*.

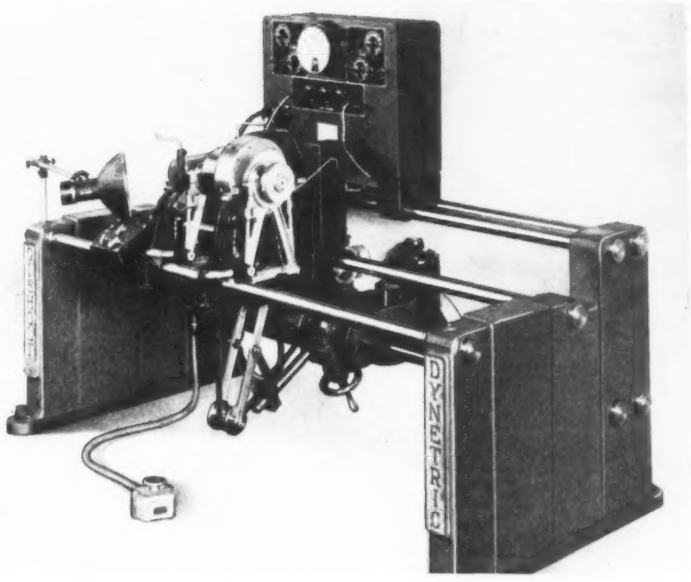


Fig. 5. Obtaining Dynamic Balance of Ring-weights in a Gisholt Dynetric Balancing Machine

The cradle, or table *A*, and all attached parts of the machine may tilt about the horizontal axis determined by the pivots *C;* the amount of such tilt is indicated by means of a sensitive level attached to cradle *A*. If the distance from the locating face *G* of the fixture to the vertical spindle center line is the same as the required distance from the transverse plane of the center of gravity of the ring-weight to the locating face of the ring-weight, this fixture provides an ideal means for determining the displacement of the center of gravity of the ring-weight from its desired point. Readings on the level are obtained for the ring-weight in the position shown in Fig. 4. The fixture *E*, carrying the ring-weight and attached to spindle *B*, is then rotated 180 degrees and a second reading of the level taken. Obviously, if there is a displacement of the center of gravity of the ring-weight from the desired position, this will tend to tilt the cradle in one direction with the fixture in the position shown, and in the opposite direction when the fixture *E* is rotated 180 degrees.

Actually, the static balancing machine is arranged with a weighing device which indicates the number of ounces of force that must be applied in a vertical direction to the cradle at a distance 1 inch from the pivot axis to restore it to a level position. These force measurements are taken for both of the 180-degree positions of the fixture, and the difference between these two observed readings actually represents twice the number of ounces that must be added to the ring-weight, 1 inch from the vertical-spindle axis, to bring the transverse plane containing the center of gravity to the desired position. The actual displacement of the transverse

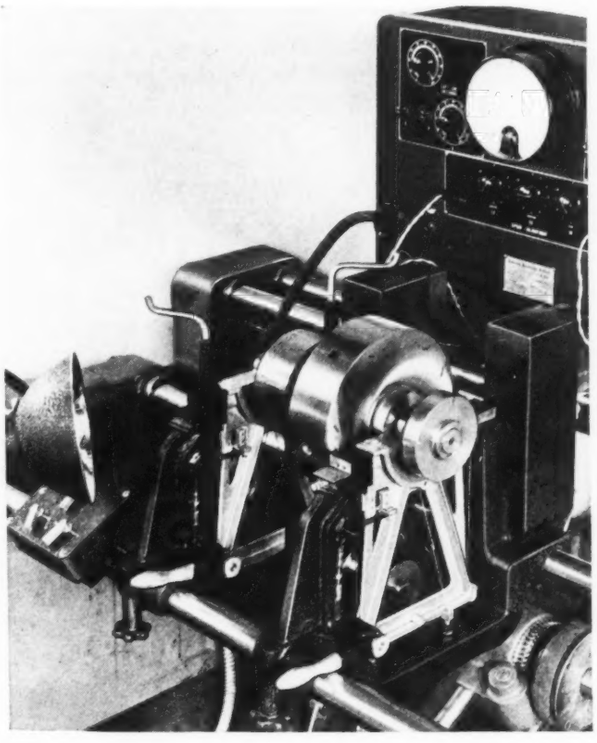


Fig. 6. A Close-up View of the Ring-weight Mounted on the Balancing Arbor of the Machine Shown in Fig. 5 for Determining the Dynamic Balance

center of gravity plane from the desired position can then be determined from the formula:

$$2 \times X = W \times 16 \times Y$$

where X = difference in static balancing machine readings for 0 and 180-degree positions of spindle, in ounce-inches;
W = weight of the ring, in pounds;
Y = displacement of the center of gravity from the desired position.

As the static balancing machine will record forces as small as 0.1 ounce at a 1-inch radius, it is obvious that this equipment will make it possible to observe deviations in the center of gravity from the desired position of about 0.0002 inch on a ring-weight weighing 60 pounds.

Method of Obtaining Dynamic Balance in Ring-Weights

The ring-weights are checked for dynamic balance on the Gisholt Type 3S Dynetric balancing machine shown in Fig. 5. A close-up view of the ring-weight mounted on the balancing arbor, which is carried in the flexible supports of the machine, is shown in Fig. 6. Since the balancing arbor is made the same diameter as the crankpin, the ring-weight actually fits the balancing arbor in the same manner as it will fit the crankpin of the radial motor crankshaft. The flexible supports of the Dynetric machine are caused to vibrate by any unbalance in the ring-weight, and this vibration is transmitted to a coil which is in the field of a powerful permanent magnet. The voltage generated in this pick-up coil is amplified 1,600,000 times, so that very clear and distinct indications of unbalance are read on the amount-meter of the balancing machine. As a matter of fact, movements in the flexible support of 0.000025 inch will give distinct readings on the meter, and such vibration will be produced by a static unbalance of 0.024 ounce-inch in a ring weighing 60 pounds.

With the ring-weight made in the manner outlined, and the use of the equipment here described, radial aircraft motor crankshafts can be balanced to a high degree of accuracy, and it is possible to return these cranks to the balancing machine, and apply any one of a group of ring-weights to the shafts for checking purposes at a later date, with the assurance that the crankshaft balance will check for accuracy.

* * *

Our Methods of Taxation Need Re-Examination

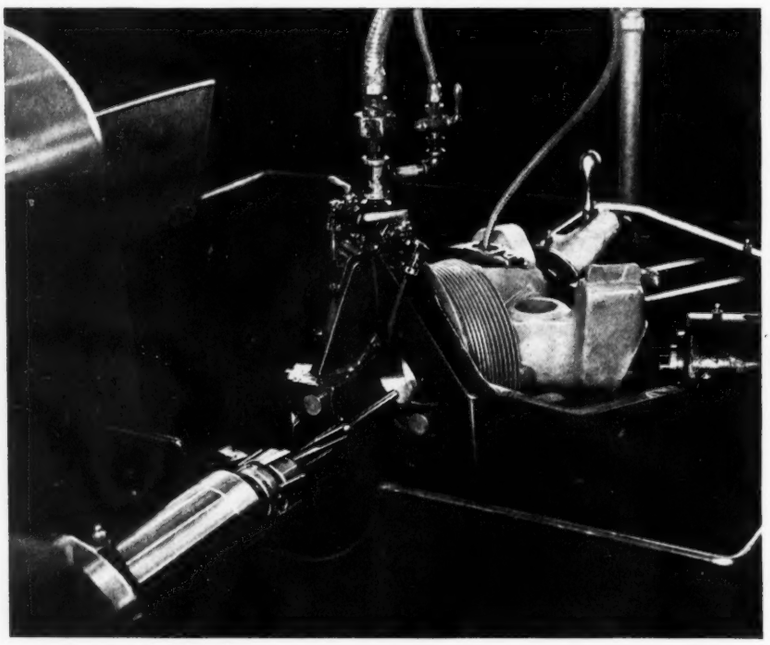
Have we not reached the stage in our Topsy-like tax scheme—"that just grew"—where we should re-examine the entire structure to ascertain just how much taxation industry can support without destroying the possibilities of re-employment and prosperity? I feel very definitely that encroachments in this direction are now not only taxing the golden eggs of earnings and profits, but slowly strangling the goose which lays those eggs.

One of the first concerns of government should be to remove all levies which discourage the investment of capital in production. We should forget all the something-for-nothing theories; all the governmental Santa Clauses. We have only what we produce in this country to share among 130,000,000 people, and with government in the form of taxes. We should not follow policies which inevitably reduce the total product to be shared.—*Howard Coonley, past-president of the National Association of Manufacturers*

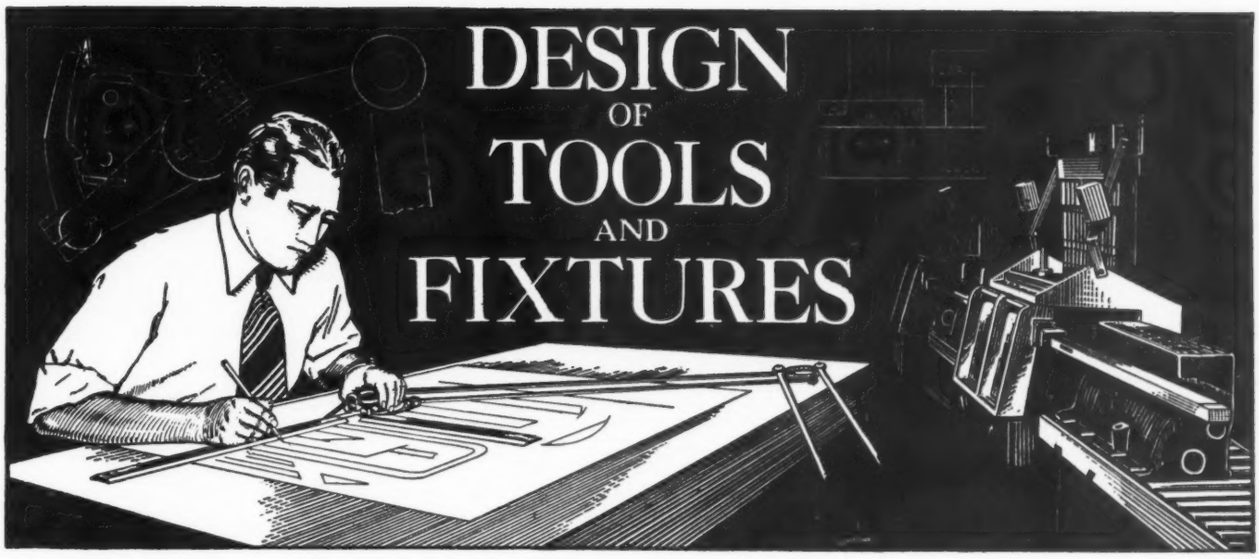
* * *

Drilling and Reaming Valve Guide Holes in Airplane-Engine Cylinder Heads

The valve guide holes in cylinder heads for Pratt & Whitney aircraft engines are drilled and reamed, and the valve-seat holes bored, on Natco machines of the design shown in the accompanying illustration. These machines are provided with a single cutter-spindle in which the tools are interchanged, and a fixture that is indexed for presenting the intake and exhaust sides of the cylinder head toward the cutter-spindle. Four tools are used on each exhaust side and six tools on the intake side of the cylinder heads.



The Intake and Exhaust Sides of Cylinder Heads are Drilled, Bored, and Reamed by Interchanging Tools and Indexing the Work Fixture

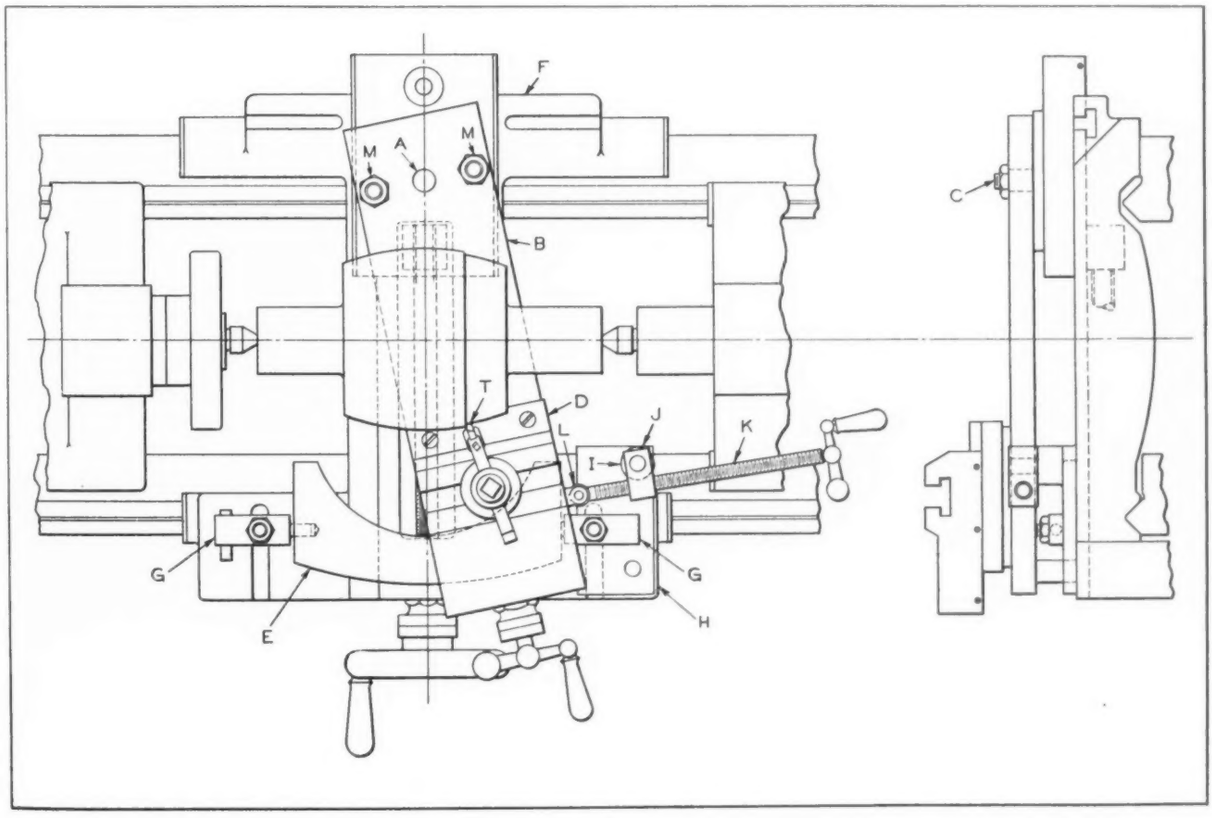


Lathe Set-Up for Turning Work to a Given Radius and Diameter

By C. J. TOONEN, Green Bay, Wis.

The problem of turning work to a given radius in combination with a given diameter was solved by moving the pivotal point of the lathe compound rest from its normal place to that shown at *A* in the accompanying illustration. The swinging bar *B* has a hole through it at *A* which fits the pivot *C* about which the compound rest *D* is normally adjustable.

A plate *E* is made to serve both as a shim and a slide bearing for the swinging bar *B*. Plate *E* is secured to the saddle *F* by means of the dogs *G*. A plate *H*, fastened to the saddle, carries a pivot *I*, on which is mounted the swinging nut *J*. The feeding screw *K* is threaded through the swinging nut *J* and connected to bar *B* by the knuckle joint *L*.



Lathe Set-up for Turning Work Held between Centers to a Given Radius and Diameter

The swinging bar *B* is secured to the pivot at *A* by the T-bolts *M*, which are used in the adjustment of the compound rest *D* when it is in its normal position. With this arrangement, the tool *T* can be fed along the required circular path by rotating the screw *K*. The carriage *F* is, of course, locked in a fixed position during the radius-turning operation.

The base of the compound rest *D* may be bolted to the swinging bar *B* at any suitable distance from the pivot point *A*. The position of the pivot can be regulated by means of the cross-feed mechanism of the carriage. By adjusting the relative positions of the pivot point *A* and the compound rest *D*, the work can be turned to any combination of diameter and radius desired.

Die for Forming Notched U-Shaped Piece from Flat Strip Stock

By VINCENT WAITKUS, Baltimore, Md.

The die shown in Fig. 1 is designed for use in forming several thousand pieces of flat metal strips like the one shown in Fig. 2 to the shape indicated in Fig. 3. The cast-iron punch member *A* is fitted with a steel punch-bar *B*. The punch-bar is pressed down by a powerful coil spring *C* located in the shank of body *A*, where it is held in place by spring retainer *D*.

The pressure exerted on the punch by spring *C* can be adjusted to suit requirements by means of the threaded retainer *D*. The portion of punch-bar *B* below collar *S* is of rectangular cross-section, and is a sliding fit in the rectangular hole in punch member *A*. This construction prevents the punch-bar from twisting, but permits it to slide smoothly in the rectangular hole.

The shank of the punch-bar has two notches near its lower end for forming indentations in the work, as shown at *e* and *f*, Fig. 3. Notch *e* is formed to an included angle of 90 degrees, whereas notch *f* has an included angle of 60 degrees, with one of the sides at right angles to the vertical axis of the punch. Punch member *A* has two wings which carry pressure rollers *E* mounted on pins *F*. Rollers *E* serve to actuate the indenting punches in the lower die member. Pins *F* are retained in their proper positions by set-screws *G*.

Cast-iron bolster *H* of the die has a cross-slot *h* in it for forming the U-shaped bend in the flat strip, Fig. 2, which is located in the cavity of the die as indicated by the dotted lines at *j*, section *X–X*. Pressure bars *J* and *I*, fitted in slots at the upper end of bolster *H*, are pivoted on pins *K*, held in place by set-screws *L*. The plungers *M* and *N* have their ends shaped properly to form notches *e* and *f*, respectively.

Plungers *M* and *N* rest in the bores *m* and *n* of bolster *H*, and are prevented from slipping out by threaded plugs *O*. A coil spring *P* in each bore serves to withdraw the plungers from the notches after the pressure has been released on bars *J* and *I*. The plungers are prevented from turning by screws *Q*, which have small pivot ends that fit into slots in the plungers. Two pilot-bars *R* are provided to maintain accurate alignment of the punch and die members. These pilot-bars are forced into punch body *A*, and are a close sliding fit in bolster *H*.

When the die is in operation, punch-bar *B* descends and pushes the rectangular strip down into slot *h* in the lower member *H*. When the strip reaches the bottom of the slot, any further

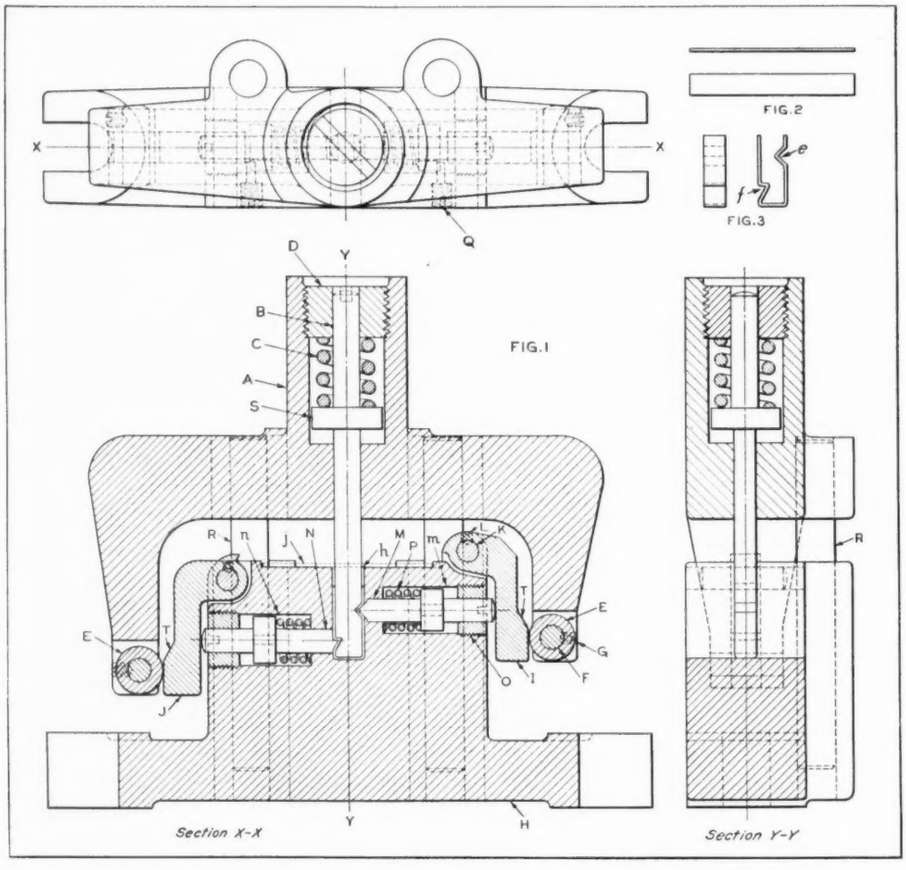


Fig. 1. Die for Forming the Piece Shown in Fig. 3 from the Flat Strip (Fig. 2) in One Stroke of the Press

movement of punch-bar *B* will cause spring *C* to be compressed. In the meantime, rollers *E* come in contact with cam surfaces *T* of pressure bars *I* and *J*, which causes plungers *M* and *N* to move inward and form notches *e* and *f*. On its upward stroke, punch member *A* carries with it punch-bar *B* and the finished product, shown in Fig. 3, which is knocked off punch-bar *B*.

Simple Welding Fixture for a Complex Fabrication

By JOSEPH I. KARASH, Tool Design Department
Reliance Electric & Engineering Co., Cleveland, Ohio

A large quantity of spiders of the design shown in Fig. 1 were to be fabricated from eight pieces of machine steel and a length of steel tubing. These spiders were 10 inches long and weighed approximately 50 pounds. They were to be fabricated by joining the nine members together with a continuous bead of weld along all adjoining edges.

A fixture was required for tack-welding the assembly together. After the tack-welding operation, continuous beads were applied by another welding operator, no fixture being required. In applying the continuous weld beads, the work could be positioned on a welding table, so that all the welding could be done "down hand."

In Fig. 2 is a sectional view of the simple tack-welding fixture. This fixture was made from a solid piece of steel and was machined to the shape shown. The fixture was made the same length as the work. It should be noted that no clamps or holding devices of any kind are used, the work being held entirely by gravity.

In tack-welding the assembly, the operator first places four pieces of steel and the steel tubing in the fixture, as indicated by the dot-and-dash lines in Fig. 2. Small beads of weld are then applied to the ends of the work at the adjoining edges. The tack-welding is placed on the ends of the work, in order to minimize any warpage due to welding, the warpage strains thus being confined to the longest section of the work.

After tack-welding the pieces together as shown in Fig. 2, the work is indexed 90 degrees and two more pieces are placed in the fixture, as shown in Fig. 3. The operator then tack-welds the two new pieces to the work. This method of assembling insures an accurate spacing of 90 degrees between the spider arms. The work is now again indexed 90 degrees, and the last two pieces are welded in place. In welding the third and fourth arms to the assembly, it is best to use alternately the two arms provided by the first operation for locating purposes. This minimizes the possibility of cumulative run-out, due to any variation in the size of the material.

The machined surface on the fixture that supports the steel tubing establishes a minimum dimension between the center line of the tubing and the extremities of the spider arms. It will be noted that the fixture is not in contact with the work at any of the surfaces to be welded. The two grooves *A* are cut in the fixture to eliminate corners in which scale or weld spatter could gather. The work is free to be lifted from the fixture at any time. From the standpoint of tool cost and speed of operation, this fixture was found to be entirely satisfactory.

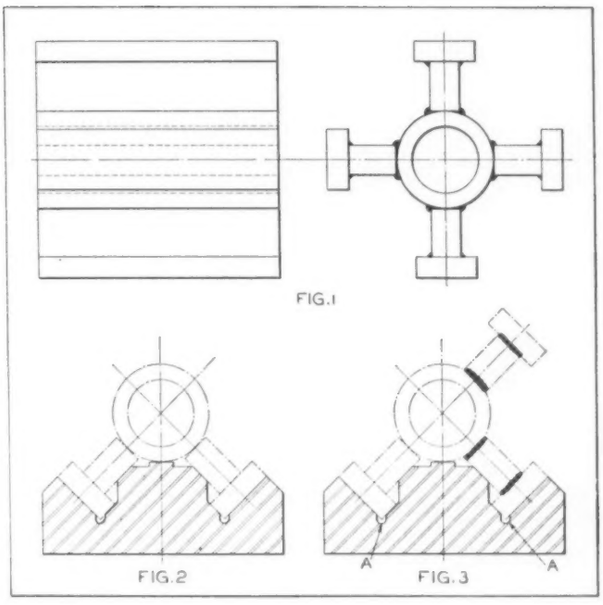


Fig. 1. Spider Weighing Fifty Pounds, Assembled by Welding together Nine Separate Pieces. Fig. 2. Cross-section of Fixture Used to Locate Pieces for Tack-welding. Fig. 3. Third Set of Pieces in Position for Tack-welding

Fixture for Use in Sawing off Connecting-Rod Caps

By EDWARD L. PETERSON, Chicago, Ill.

The fixture shown on page 138 was designed for milling bolt bosses and sawing off caps on connecting-rods *A* which are a slip fit on mandrels *B* and pins *O*. Two connecting-rods are clamped on each mandrel by means of the half split washer *C* and flanged nut *D* which is threaded on mandrel *B*. When nut *D* is loosened, washer *C* is removed. The washer is chained to the fixture to prevent it from being mislaid.

The work passes freely over flanged nut *D*. The fixture has two work-holding stations which are identical, except that one is provided with set-up gages *R* and *S*, while the other has an indexing plunger *M*. One station is employed for the milling and slitting operations, while the other is used for loading and unloading. The fixture is designed for

use on a four-spindle Cincinnati duplex milling machine.

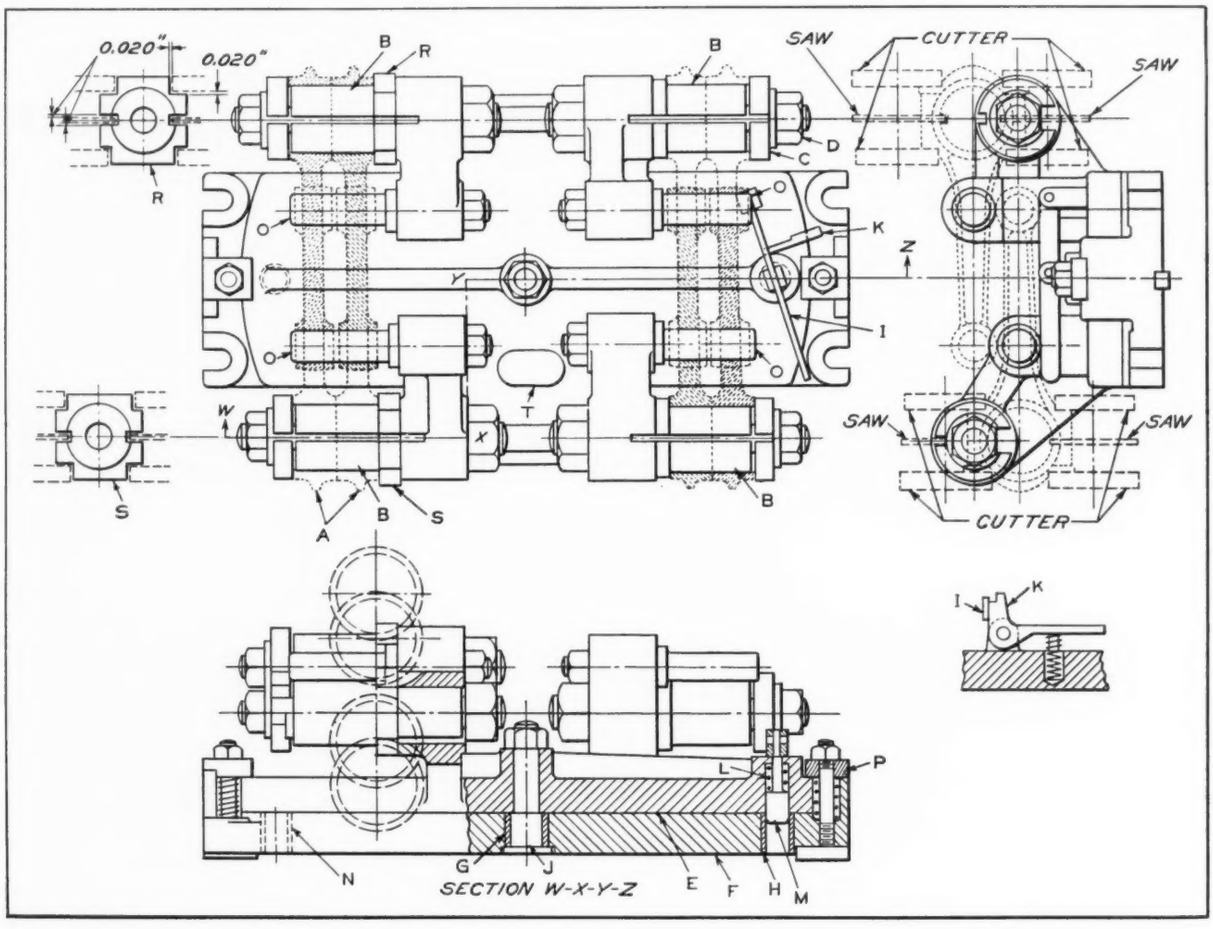
Mandrels *B* are keyed and fastened to sub-base *E*, and are located parallel with each other and with the surface of the machine table. The fixture is provided with a base *F* which is keyed and fastened to the machine table. Sub-base *E* is mounted on base *F*, a hardened and ground shoulder-screw *J* being employed to fasten it in place. Screw *J* is a close running fit in the hardened and ground bushing *G*, which is pressed into base *F*. Indexing plunger *M* enters a hardened and ground bushing *H* pressed into base *F* and locates the centers of mandrels *B* parallel with the travel of the machine table.

Lever *I* is used for disengaging the indexing plunger from base *F* when indexing, and latch *K* keeps the plunger disengaged until it is rocked away from beneath lever *I*. Compression spring *L* forces plunger *M* into another bushing *N* after sub-base *E* has been indexed 180 degrees. When the machine is operating, sub-base *E* is fastened to base *F* by means of two clamps *P*. The two views of the set-up gages shown to the left at *R* and *S* indicate the work performed by the milling and cutting-off operations, as well as the method of locating the cutters and saws. The locating of the milling cutters and the centering of the slitting saws are accomplished by using feeler gages 0.020 inch thick, there being a clearance of 0.020 inch between the locating surfaces of the blocks *R* and *S* and the cutters and saws. The thickness of the feeler gage to be used is stamped on the pad *T*.

* * *

New Method of Stripping off Accumulations in Paint Spray Booths

A novel method which makes it possible to strip off accumulated waste paint, lacquer, enamel, etc., in sheets from the walls of spray booths has been developed by the Harris Soap Co., Buffalo, N. Y. The new method consists of applying a coating known as "Boothcote" to the walls of the booth. This coating is easily applied to the metal spray booth wall with a spray gun. When the waste paint builds up on top of this film, it adheres to the metal so lightly that it can be easily pulled off in a sheet. Yet as much as a half-inch thickness of paint can accumulate on the coating without the paint falling away from the wall.



Indexing Fixture Used on Four-spindle Cincinnati Duplex Milling Machine for Milling and Cutting-off Connecting-rod Caps

Ideas for the Shop and Drafting-Room

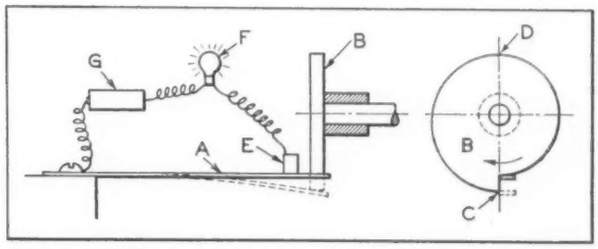
Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Simple Method of Timing the Recoil Action of Springs

In designing high-speed machines it is frequently necessary to determine the time required for a spring to recoil, in order to avoid operating the machine at a speed too high to permit the spring to function properly. A simple arrangement for finding the recoil time for a flat spring *A* is shown in the accompanying illustration. The cam disk *B*, when revolved, causes the spring to be deflected or placed in tension and then suddenly released, so that it makes contact with the stop *E* and thus completes the electrical circuit comprising the battery *G* and electric lamp *F*. A flashlight cell with its lamp can be used for this purpose.

The cam portion of the disk starts to rise at point *D* and ends at its greatest height at *C*. When the cam disk is revolving in the direction indicated by the arrow at a speed that permits the spring to drop somewhere between the points *C* and *D* of the low part of the cam, the spring will make contact with its stop *E*, causing the lamp *F* to light up or flash on and off.

Increasing the speed of the cam disk to a certain point will cause the spring to land a little beyond the point *D* on the cam, so that the lamp will fail to light up. The time required for the spring to drop from its high position on the cam to a point where it just fails to contact with stop *E* is accomplished during about one-half a revolution of the cam disk. If the cam disk has just reached a speed of 500 revolutions a second when the lamp fails to light up, it is obvious that the time required for the spring to recoil is 0.001 second, or the same as the time required for the cam disk to make one-half revolution.



Simple Arrangement for Finding Recoil Time of Flat Spring A

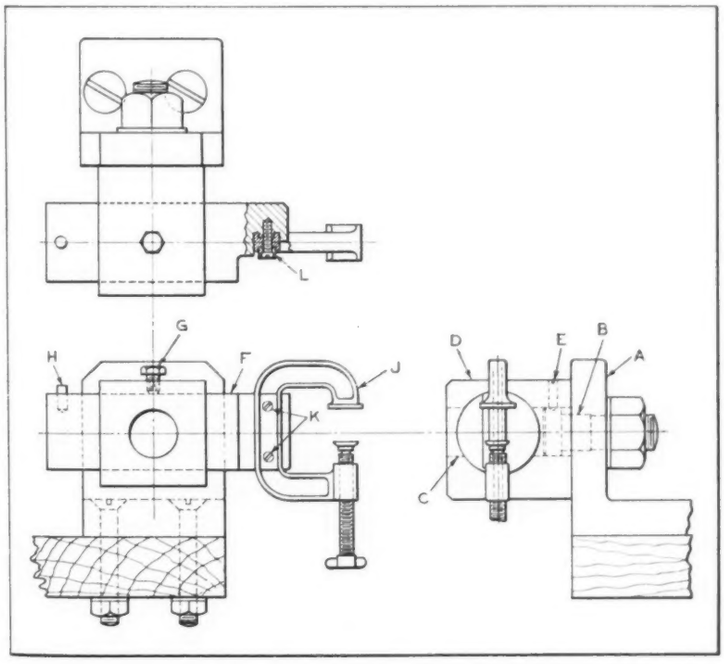
Oakland, Calif. M. JACKER

Universal Welding, Brazing, or Soldering Vise

For a low-cost universal welding, brazing, or soldering vise such as is required in repair or maintenance departments, the writer believes that it is difficult to improve on the construction shown in the accompanying illustration. Angle-iron *A*, bolted to the bench, has a hole drilled through it to accommodate stud *B*. This stud is passed through hole *C* in block *D* to receive shaft *F*. Shaft *F* is clamped in position by means of screw *G* and is prevented from coming out of block *D* by pin *H*.

The front end of shaft *F* is milled to fit the frame of a standard C-clamp *J*, and is tapped to accommodate two clamp-screws *K* which fasten clamping plate *L* and clamp *J* in place. It will be evident that this vise can be set at any angle in any plane, which is of considerable advantage in welding structural shapes.

Bloomfield, N. J. J. A. HONEGGER



Welding and Soldering Vise Designed to Hold Work at Any Desired Angle

Photo-Electric and Electronic Controls in the Machinery Field

By BENJAMIN W. STEVERMAN
Photoswitch Incorporated, Cambridge, Mass.

UNTIL the last several years, few machine designers were familiar with the "electric eye," and it was usually resorted to only after all attempts to solve a problem mechanically had been exhausted. Today, such means are often considered in the original design, and photo-electric and other types of electronic controls are steadily gaining recognition as useful auxiliary equipment for controlling machines and processes.

The development of rugged, reliable electronic controls as standard proven equipment has been of primary importance in bringing about this change. In fact, the electronic product generally has a reliability and length of life far exceeding that of the mechanical device it replaces, plus the advantage of simplicity.

Some of the photo-electric controls described in this article accomplish what could not be done before by any other means. In other cases, the electronic device used is better and simpler than its mechanical counterpart. Most of these are available as standard products of several manufacturers, although in some instances, alterations are necessary to meet space limitations of special machines.

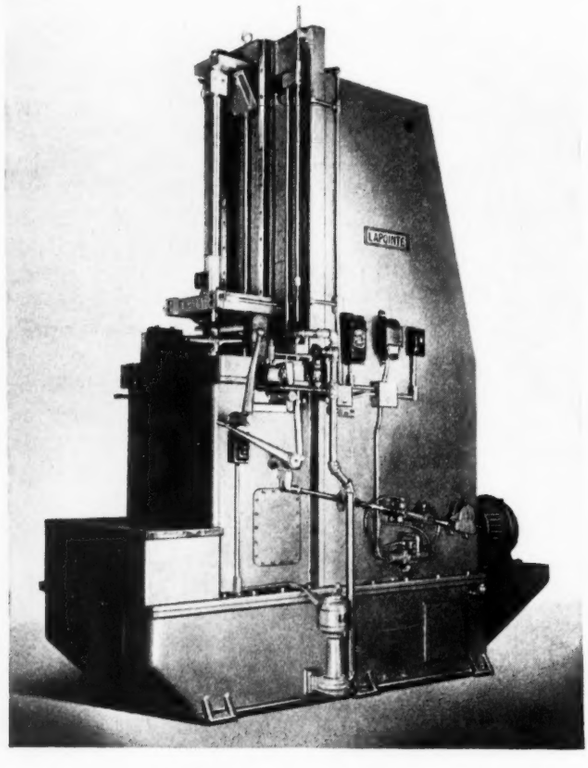


Fig. 1. Photo-electric Control Used in Connection with a Broaching Machine Prevents a Return Stroke of the Broach until the Work is Removed

For each particular control problem, the following factors have to be considered: (a) Range of operation, or distance between light source and photo-electric control; (b) speed of operation, including both number of operations per second and time relationship between "light on" and "light off" operation; (c) condition of local extraneous light; (d) function to be controlled in the output; and (e) circuit requirements—whether normally open or closed with "light on."

Photo-electric equipment, simple in design, rugged in construction, and reliable in operation, is available to meet almost any combination of these factors. Operation from an impulse as short as 0.001 second is entirely practical, and the operating range is only limited by the distance over which the controlling light beam may be projected. The controlling light beam is referred to in this article as the photo-electric control beam. It is generally a parallel light beam projected by a low-voltage lamp through a condensing lens system.

Electronic Timers and Pilot Relays

In addition to photo-electric controls, this article discusses applications of two other very useful electronic products—the electronic timer and the electronic pilot relay.

The electronic timer is used for interval timing and functions over a range from a fraction of a second to two minutes. Its timing cycle can be started by either momentarily closing the control contacts or by maintaining these closed. It is the only timing means that is accurate on intervals of less than five seconds in that it does not depend upon friction for the delayed action. The electronic timer is likewise most suitable for continuous repeat-cycle timing because its life, as compared with mechanical or other electrical timing means, is practically unlimited.

The electronic timer is used on X-ray apparatus, on plastic injection molders, and on certain automatic machine tools, such as grinding machines, automatic milling machines, etc., where the cycle of operation is less than two minutes. It is used extensively in combination with photo-electric controls for controlling paint spray valves. In this case, the object to be painted, moving along on a conveyor, interrupts the photo-electric control beam. This starts the timer on its cycle and turns on the paint spray. When the timer has completed

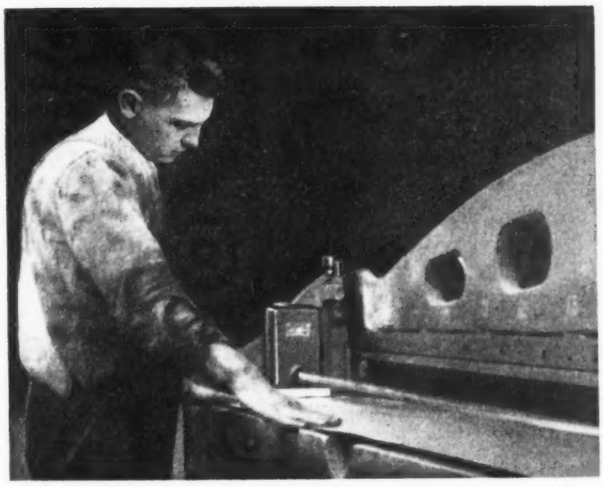


Fig. 2. Photo-electric Control which Stops the Movement of a Shear Blade if the Operator's Hands Enter the Danger Zone

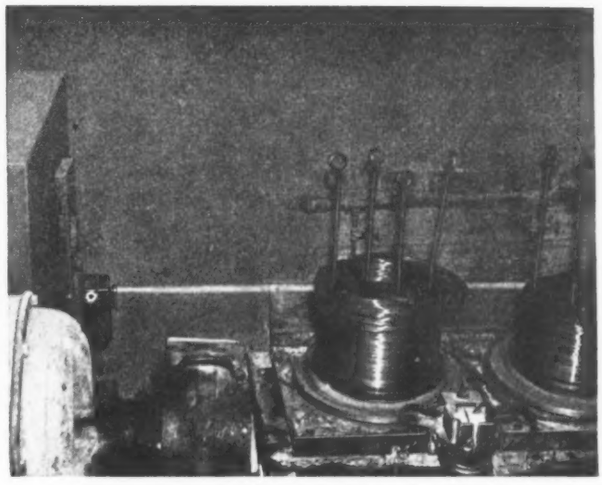


Fig. 3. A Photo-electric Device Stops the Wire Draw-bench Instantly in Case of an Accident Caused by the Revolving Spools

its interval, it turns off the spray. Automotive manufacturers use electronic timers for automatic tire inflation.

The electronic pilot relay renders possible the control of large electrical loads by delicate mechanisms and light contact pressures. It increases indefinitely the contact life on meter relays, limit switches, automatic precision gage controls, etc., for with the electronic pilot relay, a current of three-millionths ampere in the activating circuit can control any required load.

The electronic pilot relay is extensively used for liquid level control. In this case, the actuating probes of the relay circuit are suspended over the liquid at the height at which control is desired, and the liquid short-circuits the probes when it rises to this level. Since the actuating circuit may have a resistance of several million ohms, liquids of very low electrical conductivity, such as refrigerants, may be controlled.

Applications in the Metal-Working and Metal-Refining Industries

The electronic control is becoming an important factor in the machine tool field. In many cases, it makes higher production speeds possible and large-quantity production more completely automatic. It serves the worker as a machinery safeguard on dangerous shears and presses, preventing operation of the machine if the worker's hand is in danger.

Automatic presses can be completely controlled with electronic equipment. Thus, the control beam may be projected across the path of the material leaving the press, so that high-speed photo-electric controls will shut down the press if a piece of material is not ejected at the end of each stroke. A jammed press or no more material entering the press would also result in operation of the control.

Wrinkles and other irregularities in the material being fed to the press are detected in the following manner: A roller on the end of a lever rides along the material as it is fed to the press. If the roller encounters a wrinkle in the material it is raised, which causes the lever to move also. On the end of the lever opposite the roller are electrical contacts which are operated by this movement of the lever. When a wrinkle greater than a predetermined minimum raises the lever, the contacts close with very light pressure. This closes the operating circuit of an electronic pilot relay, which shuts down the press.

After stamping or forming, metal pieces are often ejected into bins. Photo-electric control is used to regulate the stock level of these bins. The photo-electric control beam is projected across the bin at a certain level. When the material in the bin rises to this point, the control operates either an elevator to lower the stock or a conveyor to carry finished pieces away.

The electronic pilot relay is used to advantage on automatic duplicating machines. It is customary for the cutting arm of automatic duplicators to follow a master arm, which is guided by a plaster pattern. A copper plate having the pattern painted on it with insulating varnish is now substituted for the plaster pattern, and two pilot relays cause a light metal feeler to follow the painted outline accurately. This may be applied, as well, to automatic torch cutting, and other processes where cutting is accomplished automatically by the use of a master pattern.

A Lapointe broaching machine particularly designed for machining propeller hubs is shown in Fig. 1. The photo-electric control in this case is for protecting the broach. The broach-reversing button is connected in series with this control, and the broach is prevented from returning to the top of its stroke until the finished work is removed.

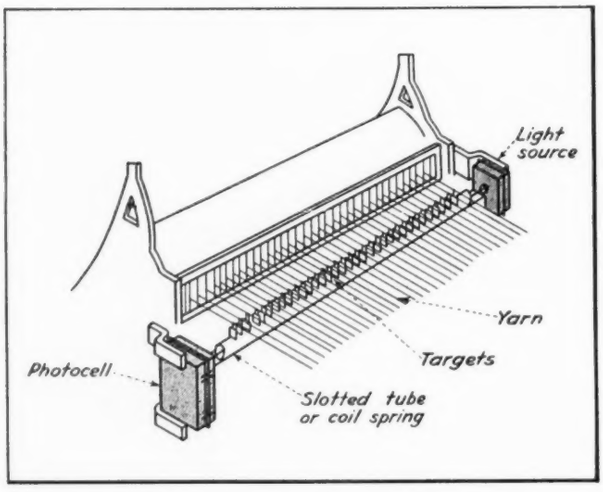


Fig. 4. Photo-electric Beam Projected beneath Targets that are Suspended from Each Thread of a Textile Machine. If a Thread Breaks, the Target will Drop and Interrupt the Beam, Stopping the Machine

A photo-electric safeguard on a shear is shown in Fig. 2. The shear blade will not close if the operator's hand is near the jaw of the machine. Photo-electric safeguards often serve as press controls, increasing production speeds. In this case, the press operates automatically as soon as the operator's hand is out of danger.

Photo-electric control is useful in refining and processing steel and other metals. In the control of conveyors or reversing reducing rolls, etc., recourse is made to the photo-electric limit switch. On such applications, the heat and light radiated from red-hot metals often is sufficient to positively operate a photo-electric system. In rolling mills, the sheets are restrained within their proper channels by photo-electric edge control. The photo-electric control is also effectively used to detect "cobbles" or wrinkles in metal slabs during rolling, and to provide the required stop motion control when "cobbles" are present.

Uniformity in resistance heating is often accomplished through photo-electric control. When it is essential to control a process according to the temperature of the metal on which the operation is being performed, the combination of heat and light radiated by the metal are the most accurate standards. A photo-electric system, properly designed for stable operation under these conditions, and equipped with suitable red filters, is used. This is particularly useful in production resistance welding of metal parts, such as chain links.

Photo-Electric Applications in Wire Manufacturing

There are twenty dies on the 50-foot wire drawbench shown in Fig. 3. Should the workmen, in making adjustments, become entangled in the revolving spools, they are dragged across a photo-electric control beam which projects the entire length of the bench. This instantly stops the drawbench and averts serious injury.

In stranding wire, the electronic pilot relay is used to detect wire breaks. The wire revolves constantly during the stranding. When a strand breaks, it flies outward, due to centrifugal force, and in so doing, strikes a metal ring. This closes the operating circuit of an electronic pilot relay, which stops the strander. Large stranding machines are occasionally surrounded by light-beam fences to keep workmen from the area where there would be danger in case the spools should break loose and be thrown out of the machine.

The photo-electric control is used to detect kinks in unwinding cable. It is applied to maintain a constant lag between capstan and reel in cable winding. A similar application for winding cloth on spools is subsequently described.

Thread Break Detection and Other Textile Uses

Textile warpers, looms, and winders are equipped with mechanical and electrical controls for stopping the operation when a thread breaks. Light copper drop wires, suspended from each thread, ride on long copper electrode strips. When a thread breaks, its copper wire drops and closes a circuit between two portions of the electrode strip. This provides the controlling means for stopping the loom. Because the drop wires are necessarily light and gather lint and dust, they are likely to arc and make poor electrical contact. Here the electronic pilot relay is introduced to advantage. The drop-wire circuit need only carry one-millionth ampere of electrical current if the pilot relay is

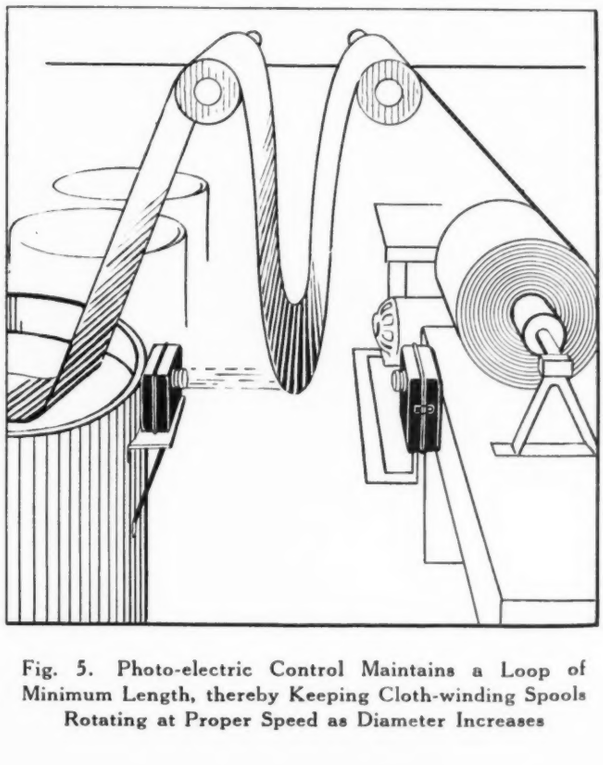


Fig. 5. Photo-electric Control Maintains a Loop of Minimum Length, thereby Keeping Cloth-winding Spools Rotating at Proper Speed as Diameter Increases

introduced between this circuit and the switch controlling the machine.

Where a more positive stop-motion control in thread-break detection is desired, the photo-electric control is used. This can be applied wherever space permits alignment of small targets suspended from each thread. As shown in Fig. 4, the targets are aligned just above the photo-electric control beam. When a thread breaks, its target drops, operating the photo-electric control, which turns off the machine.

In textile finishing plants, the cloth passes through large drying ovens. To maintain uniform tension in the cloth, it is necessary for the spacing between the guider arms to vary as the cloth narrows and broadens, and this is accomplished by reversing motors operated by feeler switches which ride on the edge of the cloth. With cloth that is tender when wet, the edge of the cloth must wrinkle before the feelers will give the desired control. Photo-electric control substituted for the feeler switches eliminates this undesirable feature. The breaking of the light beam requires no pressure of the cloth and gives a more positive and accurate guider-arm control.

When sensitive feeler switches are used to provide edge control for tenter drier guider arms, the contact life of the switch is increased by introducing electronic pilot relays between the feeler switch and the forward and reverse motor control.

It is often desirable, in winding cloth on spools after processing, to maintain constant tension in the cloth. If the cloth is wound at a constant number of revolutions per minute, it will actually wind faster as the diameter of the wound spool increases. Since most cloth-processing is done at constant speed, gradually increasing the differential in speed between the processing and the winding introduces tension in the cloth, if not compensated for.

The simplest method of providing this compensation is to introduce a loop in the cloth just ahead of the winding spool, as shown in Fig. 5. The photo-electric control beam is projected across this loop, so that the beam will not strike the photo-electric cell until the loop has reached a pre-established minimum size. When the loop has been reduced to this extent, the photo-electric control operates and introduces the speed-compensating device. This may be in the form of additional resistance in the field of a direct-current motor. The loop is thus maintained at all times in the cloth, and the tension is constant.

Paper Manufacturing and the Packaging Industry

Paper mills, as well as printing establishments, use photo-electric control to stop processes as soon as a break in the paper is detected. When paper is being chemically coated by a series of rolls, it is particularly important that a break be detected instantly, so that the coating will not be transmitted from roll to roll, due to the absence of the paper.

In this case, the photo-electric control beam is aligned vertically or diagonally in the path of the paper. Under normal conditions, the control beam will be interrupted by the paper and will not reach the photo-electric control. When a break occurs, however, the light beam will reach the photo-tube through the break, thus operating the photo-electric control, and either signaling the machine operator or automatically stopping the process.

Automatic cut-off is accomplished by photo-electric means in sizing paper sheets. The paper is fed along the cutting bench until a predetermined length has passed under the open shear. The photo-electric control beam has been set at this predetermined distance from the shear, in line with the path of the paper. When the paper breaks the control beam, the photo-electric control stops the paper feed and the shear makes the cut-off. This is also accomplished in some installations by a sensitive limit switch operating an electronic pilot relay.

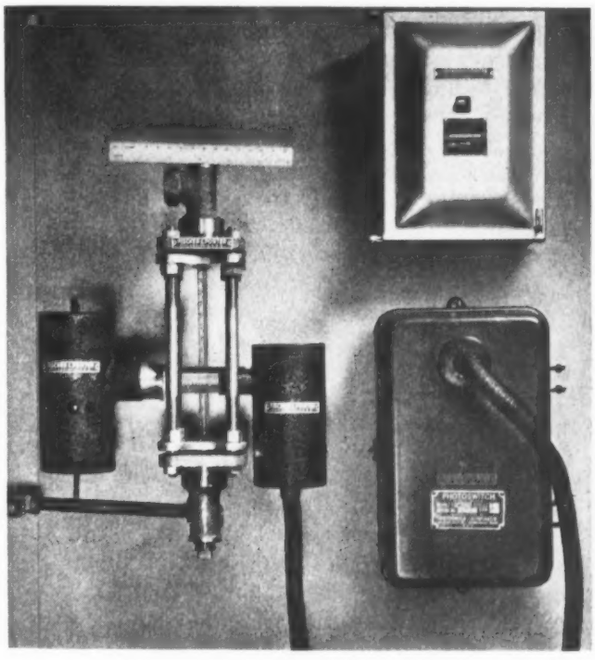


Fig. 6. A Rate-of-flow Meter is Operated by a Photo-electric Control when the Metal Float in the Meter Reaches a Predetermined Level

When labels and wrappers are being cut to size, it is essential that each unit be properly indexed with reference to the printed material thereon. Owing to the stretching and shrinkage of paper, cut-off can only be kept in register by continuous reference to marks printed on each wrapper. A dot 1/16 inch in diameter is sufficient for high-speed photo-electric equipment to index this machinery.

The photo-electric control is used to make speed compensations automatically on these label machines. The machine can be set to constantly over-

feed, in which case the registration mark will gradually creep off register and the photo-electric control, at intervals, will cut down the speed of operation. More generally, the speed of the machine is set as accurately as possible and a dual electronic system provides two-directional speed correction when required.

Automatic Control from Scale and Meter Readings

The readings of meters and scales of many types provide automatic control of machinery and processes through the use of electronic equipment. The electronic pilot relay increases the life of meter relays many times by greatly reducing the current which their very light contact pressure is called upon to handle.

Photo-electric control is used for automatic weighing, both with beam and dial scales. In the case of the beam scale, the light source and the photo-electric control, compactly housed, are mounted on an adjustable arm, so that they can be swung in front of any scale reading. The photo-electric control beam is projected directly on a flat mirror strip which extends around the circumference of the scale face. This mirror reflects the control beam back to the photo-electric cell. When the scale needle swings to the reading at which automatic control is desired, it interrupts the photo-electric control beam, and the photo-electric unit operates a valve or other control.

Automatic control is provided from gage glass readings by photo-electric means. Indication is often required of the level of liquid in a gage glass or of its change in color and transparency. A Fischer-Porter rate-of-flow meter is shown in Fig. 6. Automatic valve control is provided when the metal float in the meter glass reaches a height where it will interrupt the photo-electric control beam.

The applications briefly described in this article are typical of the many uses to which photo-electric and electronic controls are being applied in various manufacturing processes. Indicative of their widespread use is this partial list of some general applications in the automotive industry: (a) Automatic door operation; (b) control of paint spraying; (c) automatic precision gaging of parts to 0.002 inch; (d) fencing off dangerous area where car chassis are swung upside down during assembly; (e) conveyor control, and counting; (f) operator safeguards for punch presses; (g) automatic control of splash tests; (h) control of sand-blasting of small parts with photo-electric control and electronic timer; (i) control of lights in radiation driers; (j) electronic timing of tire inflation.

In selecting electronic equipment, care should be exercised to insure that it is of high quality and built to industrial rather than laboratory specifications. Components, such as condensers and photo-tubes, should be of a design that will operate under exacting factory conditions without maintenance for many years. Equipment should be chosen which has been carefully tested under conditions of high and low temperature, varying humidity, and rapid rate of temperature change.

Whenever possible, standard equipment should be used. The designing and building of special equipment for a job is expensive, and there may be the added disadvantage of not knowing how the equipment will stand up over a long period of time. With proper choice of equipment, however, the photo-electric control will require practically no maintenance and will generally outlast the machine on which it has been installed.

Tool Engineers to Meet in Cincinnati

THE semi-annual meeting of the American Society of Tool Engineers will be held at the Hotel Gibson, Cincinnati, Ohio, October 17 to 19. Training and education to meet the increasing national shortage of tool engineers and designers, as well as of skilled craftsmen, in the machinery industries will be the chief subject of the meeting. General sessions on each of the first two days of the meeting will be given over to this subject.

Among the addresses will be one on "Importance of Engineering Preparedness," by F. E. Searle, of the Ford Trade School. Dr. R. C. Gowdy, dean of the College of Engineering and Commerce, University of Cincinnati, will discuss "Cooperative Education." W. S. Dowman, assistant director of sales and office personnel, Goodyear Tire & Rubber Co., will speak on "Industry's Post-Graduate Course." Whiting Williams, industrial consultant, will talk on "What We Can Learn from Europe." George Schiele, chief inspector and member of the board, Cincinnati Milling Machine Co., will lead the discussion on the various papers presented.

Saturday, October 19, there will be a technical session devoted to the subject of gear finishing, with papers presented by Marvin R. Anderson, vice-president, and Charles Staub, chief engineer, Michigan Tool Co.; Otto H. Schafer, president, Schafer Gear Works; I. J. Gruenberg, chief engineer, Gear Grinding Machine Co.; and Charles Pfeffer, in charge of gear development and production, Wright Aeronautical Corporation.

During the convention, the tool engineers will have an opportunity to visit a number of the machine tool and other industrial plants in Cincinnati with a view to becoming acquainted with current developments in the machine tool and allied fields in anticipation of tooling needs for the National Defense program.

Hydraulic and Mechanical Methods of Forging Shells

AT the meeting on shell production sponsored by the American Society of Mechanical Engineers in Pittsburgh, September 11, Frederick G. Schranz, general manager of the Baldwin-Southwark Division of the Baldwin Locomotive Works, Eddystone, Pa., read a paper on "Hydraulic and Mechanical Methods of Forging Shells."

Referring to press capacities, the following sizes of hydraulic presses were suggested for different sizes of shells: For 3-inch shells, 300-ton piercing presses and 200-ton vertical drawing presses. For 4 1/2-inch shells, 400-ton piercing presses and 200-ton horizontal drawing presses. For 6-inch shells, 500-ton piercing presses and 210-ton horizontal drawing presses. For 8-inch shells, 800-ton piercing presses and 240-ton horizontal drawing presses. For 9.2-inch shells, 1000-ton piercing presses and 260-ton horizontal drawing presses. For 12-inch shells, 1200-ton piercing presses and 340-ton horizontal drawing presses. For 15-inch shells, 2500-ton piercing presses and 700-ton horizontal drawing presses.

In the last war, round billets were used for shell forgings, but, in some cases, cast ingots were employed for the larger sizes of shells. Small-sized round bars were nicked and broken, while the larger sizes of bars were cut off in a multiple-head cutting-off lathe. Today, gas nicking and gas cutting are frequently used for billets up to 8 inches square. For breaking the billets, power and hydraulic presses from 100 to 250 tons are employed. Instead of round billets such as were used in the last war for the smaller sizes of shells, square billets are now also being used. With a square billet, which is only slightly longer than the pierced shell, the piercing mandrel expands the billet into a round body. This saves wear on the tools and reduces the press capacity required for piercing.

For heating the billets, a new type of rotary-hearth oil-fired furnace is now on the market. Such furnaces have a heating capacity for from 5000 to 20,000 pounds of billets per hour. The furnaces range from 11 to 17 feet inside diameter. In these rotary furnaces, the billets stand on end, thus exposing the entire billet to a uniform soaking heat. After being heated to 2200 degrees F. in a furnace temperature of 2350 degrees F., the billets have only a thin, flaky scale.

Dies for Forging Shells in Hydraulic Presses

Shell forging dies used on hydraulic presses consist of piercing and drawing dies. The piercing and drawing dies for the smaller sizes of shells are of either the single- or double-pot type, with corresponding piercing mandrels. Before the shell is pierced, a slugging punch is sometimes used. This slugging punch is attached to a slide which also carries the piercing mandrel. After the billet is placed in the piercing pot, the slugging punch pushes it in tightly, thus filling the pot and forming the conical shell bottom. It also provides a depression on top of the billet to guide the nose of the piercing mandrel.

Usually, the piercing mandrel is attached to the moving platen of the press, while the piercing pot rests on the bottom press platen. For forging large sizes of shells, the piercing mandrel and pot are moved laterally. With such a moving die arrangement, two piercing mandrels are used, one of which is piercing while the other, during the down movement of the press platen, is immersed in an oil tank for cooling.

An arrangement of two piercing pots attached to a bottom sliding table will allow the pierced billet to be ejected from one piercing pot outside of the press columns and the pot to be refilled with a new hot billet, while the second pot is used for piercing under the center of the press. This permits the use of a shorter press stroke.

In a more recent die development, the piercing pot is attached to the moving platen of the press in an inverted position, while the mandrel is stationary in the bottom platen, guided by a stripper plate. This die arrangement allows the pierced shell to be stripped from the mandrel on the return stroke of the press, while the shell is stripped from the piercing pot when the moving press platen reaches its top position. When the shell is ejected from the inverted pot, any scale that may have lodged in the pot will automatically fall out.

The stripper plate and the lower face of the piercing pot are provided with a tongue and recess, so that they will center themselves. The heated billet is placed on the stripper plate; and when the billet is covered by the down-moving piercing pot, the piercing operation is started. This method produces concentric forgings.

Hydraulic Roller Type of Drawing Press

A new type of roller die-head, horizontal, hydraulic drawing press is now being used. This type of press produces a shell with a smoother inside finish, and also rolls the metal over the drawing mandrel instead of forcing it through solid drawing rings. The rolling action improves the quality of the steel in the shell.

In all cases, provision must be made for cooling the piercing and drawing dies. Lubricant for the piercing dies should be applied at every stroke of the press. Good lubricants will be suggested by the leading oil companies. For the drawing mandrel, a mixture of quenching oil and graphite has given good results.

The Application of Mechanical Presses for Producing Shells

Instead of producing the smaller sizes of shells on hydraulic presses, mechanically operated presses or forging machines are being used. One type of forging machine uses round billets of a length suitable to make two shells from one billet. In this machine, each end of the billet is pierced by a progressive die arrangement in five or six stages; following this operation the two forged shells are sheared apart.

Based on the principle of the forging machine, the Omes combined mechanical piercing and drawing machine was developed by the Skoda Works in Czechoslovakia for shells up to 105 millimeters in size. This machine is said to give highly satisfactory results in a number of plants and arsenals in England, Sweden, and Denmark. In this machine, a heated square billet is inserted into a split die. The billet rests on the lower surface of the die. By actuating a foot-pedal, the die is closed, while the piercing mandrel is operated by a crankshaft to expand the hot square billet to fill the die. In opening the die, the pierced shell forging falls clear of the die, and is then put on a drawing mandrel placed beside the piercing mandrel.

In order to increase the capacity of this machine, two piercing mandrels and dies, and two drawing mandrels may be provided, so that each piercing and drawing mandrel may be used in turn. This reduces the wear and gives the mandrels time to cool between the piercing or drawing operations, thereby prolonging the tool life.

* * *

New Motion Picture Shows Stainless Steel Being Made

A color and sound motion picture dealing with the manufacture of stainless steel, from the melting furnace to the finished product, has been completed by the Allegheny Ludlum Steel Corporation, 2319 Oliver Bldg., Pittsburgh, Pa. This picture shows the complete processes involved, including tapping, teeming, cogging, rolling, and drawing of stainless steel. It shows sheet manufacturing at the company's Brackenridge, Pa., plant; wire and bar manufacturing at the Dunkirk, N. Y., plant; and a cold strip mill in operation at the Wallingford Steel Co.'s plant at Wallingford, Conn. Interested groups can obtain the film by communicating with the Allegheny Ludlum Steel Corporation at the address given above.

Electromagnetic Feeler-Gage Control

In the article "Electromagnetic Feeler-Gage Control," published on page 119 of August MACHINERY, it should have been mentioned that the gage illustrated in the line engravings and described in the article is the Electrolimit gage, manufactured exclusively by Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. The mechanical features of this gage are this company's developments in conjunction with electrical patents held by the General Electric Co., Schenectady, N. Y.

* * *

Industry States its Own Case

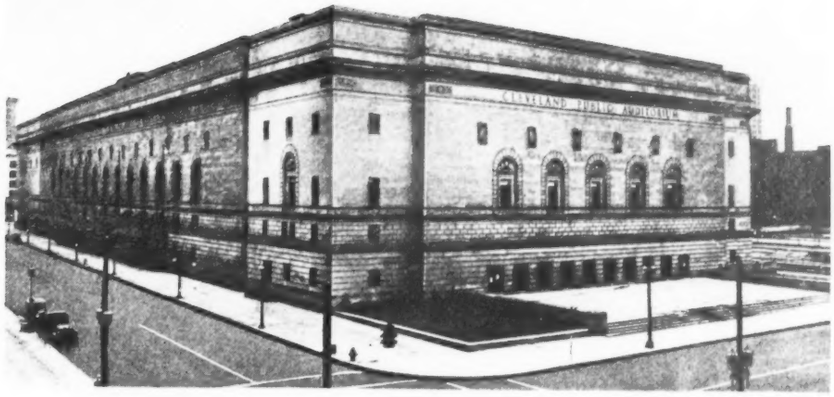
The following is quoted from a statement made to the employes of the Stewart-Warner Corporation, Chicago, Ill., by James S. Knowlson, president of the corporation. Hundreds of American industrial concerns could make similar statements as to what they have done to further the program of National Defense. It is encouraging that American industry begins to speak up. More statements of this type should be made and published.

This is what Mr. Knowlson has to say to his employes: "There has been a lot of bunk about industry in the last few years. The talk still goes on. Statements are in circulation today to the effect that American industry is holding back; refusing to cooperate with the Government; demanding large profits; etc. Some people believe that this is true.

"If your friends ask you what your company has done so far, you can tell them this: Your company has bid (on a competitive basis) on ten millions of dollars of Government work against many other companies. So far, we have been awarded approximately two million dollars worth of Government contracts. We have already begun making delivery on some of these contracts. The prices at which they were taken are such that up to July 31, we lost $60,000 on what we shipped. This loss represents what we have paid out of our own pockets to learn how to do our job. That cannot be called profiteering.

"We have purchased, or have on order, over $450,000 worth of new machinery. We are buying this machinery with our own money. That is not refusing to start until the Government finances us. There are limits to what we can do, but we have reason to be proud of what we have accomplished so far.

"There is one kind of patriotism that stands on the street corner and makes a lot of noise, and another kind that buckles down to work and does the thing that it knows how to do best. This is our country — and it is about the only country left where a man can call his soul his own. If we want to keep it that kind of country, we must all take a direct and personal interest in what goes on."



The Twenty-Second Annual National Metal Exposition

CLEVELAND, OCTOBER 21-25

OVER three hundred manufacturers in the metal industries are making plans to exhibit at the twenty-second National Metal Exposition, to be held in the Public Auditorium and Exhibition Hall at Cleveland, October 21 to 25. This exposition will be held in conjunction with the National Metal Congress in which participate the American Society for Metals, the American Welding Society, the Wire Association, and the Iron and Steel Division and the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers.

The 1940 Congress and Exposition will be the largest in the twenty-two-year history of expositions sponsored by the American Society for Metals. The great number of exhibitors and the large space to be occupied by many of the prominent exhibits are indications of the present activity in the machine-building and metal-working industries. More than 100,000 square feet of exhibit space will be occupied by exhibitors from practically every branch of the metals and allied industries.

The theme for the 1940 exposition will be "New Aids to Production"—an especially appropriate keynote that fits the gigantic defense program now under way. A great many of the exhibits will have direct relation to the preparedness program. The exhibition will afford plant executives, superintendents, metallurgists, and tool engineers an unusual opportunity to study and compare new products and processes.

The large industrial groups that are primarily represented in the exposition are the industries devoted to welding equipment, heat-treating furnaces, steel and iron and their products, non-ferrous metals, testing equipment, temperature recording and controlling equipment, metal-working tools and accessories, plating equipment, measuring devices, and accessory equipment.

In the welding exhibits, for example, equipment for all types of welding—arc, spot, and resistance—as well as gas welding and gas cutting, will be shown. The furnace group will include heat-treating furnaces of all types—gas, oil-fired and electric—as well as salt-bath furnaces. The metals exhibits will include all classes of tool steel, stainless steel, structural steel, valve steel, and heat- and corrosion-resistant steel. In the non-ferrous field, there will be exhibits of aluminum and its alloys, magnesium, copper, brass, bronze, zinc die-castings, and wire. Machines for die-casting, wire drawing and spring forming will be on exhibit. In the testing equipment section, there will be hardness, tensile, torsion, and fatigue testing devices. The tool exhibits will include drills, hacksaws, files, diamond tools, and cemented-carbide tools. Abrasive cutting machines and wheels will also be in evidence.

The technical programs arranged by the four participating societies are more comprehensive this year than ever before. Sixty-four papers will be presented in fourteen sessions before the American Society for Metals. Practically every phase of the metallurgy and heat-treatment of metals will be dealt with.

The annual fall meeting of the two metals divisions of the American Institute of Mining Engineers will be held during the first three days of the Congress. The Wire Association will present many interesting new motion pictures, in addition to technical papers. Fifty-three papers will be presented by the American Welding Society.

Condensed Review of Some Recently Developed Materials

Arranged Alphabetically by Trade Names

Class of Material	Trade Name	Properties	Applications
Die Steel	**Airkool**	A die steel with performance characteristics intermediate between those of high-carbon high-chromium and oil-hardening types. It is air-hardening, wear-resistant, and has non-deforming properties. It is hardened by cooling in air from a temperature between 1750 and 1850 degrees F.; it is tempered to from 63 to 58 Rockwell C. by drawing at temperatures from 300 to 1000 degrees F.	Suitable for applications where toughness and wear resistance are the principal requirements.
Refractory Ceramic Material	**Alsimag 222**	Machinable, ceramic material with low dielectric loss at high frequencies which can be used at temperatures up to 2500 degrees F. Available in round or tubular form and in disks or plates; special shapes also can be supplied. Because of abrasive nature, must be machined with carbide tipped tools.	Especially suitable for building working models. Also suitable for application in electronic field.
Bearing Babbitt	**Bermax**	An improved high-lead babbitt that is not subject to oil corrosion. It has a melting point slightly higher than that of tin-base bearing alloys, and can be cast by any method without fear of segregation. Maximum permissible unit pressure, 1800 pounds per square inch.	Particularly recommended for re-babbitting steel-back or bronze-back bearings or housings of cast steel or cast bronze. Suitable for a wide range of applications in the automotive, Diesel engine, pump, and compressor fields.
Welding Material	**Castolin**	Permits welding at low temperatures, so that overheating and subsequent warping of welded parts are avoided and stresses are eliminated. Lengthy preheating is also made unnecessary. The tensile strength ranges from 35,000 to 115,000 pounds per square inch.	Furnished in rod form in a variety of alloys for the welding of aluminum, steel, cast iron, brass, bronze, copper, and white metal. Castolin fluxes are also available in paste or powder form.
Light Non-ferrous Metal	**Colalloy**	A metal of silvery appearance having only one-third the weight of steel. It has outstanding electrical and thermal conductivity, is unusually resistant to corrosion, and has great strength. It can be easily worked, formed, and shaped.	Suitable for articles employed in the food industries, such as containers, pans, and trays. It is adapted for use in chemical and paint manufacturing plants, oil refineries, breweries, distilleries, rubber plants, paper mills, etc.
Atomic-welding Material	**Colaweld**	A liquid, paste, and rod for the atomic welding of metals without the use of welding apparatus. Not intended as a substitute for welding by regular methods, but for cases heretofore difficult or impossible by ordinary welding methods.	The paste and rod are intended for practically all non-ferrous materials, including aluminum; the liquid and rod for stainless and low-carbon steels and practically all ferrous alloys. Metal from 0.005 to 0.050 inch in thickness can be welded.
Metal Coating	**Colaweld Mormetal**	A coating material that can be applied with a spray, brush, or as a powder and then heated by oven, torch, or other means to produce a fusion bond. High resistance to corrosion, abrasion, and erosion is provided.	Zinc, cadmium, tin, bismuth, lead, and their alloys can be applied to ferrous and non-ferrous metals by this process. Useful for high-speed production in the fields of marine construction, transportation, building and general maintenance.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Heat-insulating Cement and High-temperature Blocks	**Coprtex**	Heat-insulating cement made from a base material of resilient long-fiber copper slag wool. The cement will bond and stick to clean surfaces of any type of material. Average adhesive strength, 30 pounds per square inch. It will withstand a temperature of 2000 degrees F. The high-temperature Coprtex blocks have a maximum temperature limit of 1800 degrees F.	The cement is suitable for making repairs or changes in steam lines, headers, boilers, or similar equipment. High-temperature blocks may be used where superior insulating efficiency is required.
Stainless-steel-clad Plate	**Croloy**	A carbon-molybdenum steel with thin sheets of chromium stainless-steel welded to it. Can be hot-formed, spun, or welded as easily as unbonded plate.	Useful where strength, as well as resistance to corrosion, is required.
High-temperature Alloy Steel	**Croloy 7**	Analysis: Carbon, 0.15 per cent max.; manganese, 0.50 per cent max.; phosphorus 0.030 per cent max.; sulphur 0.030 per cent max.; silicon 0.50 to 1.00 per cent; chromium 6.50 to 7.50 per cent, and molybdenum 0.45 to 0.65 per cent. Offers considerable resistance to corrosion and oxidation.	Suitable for high-temperature applications, such as oil refinery cracking-still tubes and steam superheaters.
Copper-iron Alloy	**Cuferco**	This material has an electrical conductivity about 70 per cent that of copper, and a tensile strength about equal to hot-rolled, low-carbon machinery steel. It has a tensile endurance limit 23 per cent higher than that of Cupaloy.	Particularly suitable for tips for spot welders, since it can be hardened by heat-treating and is softened very little by repeated applications of heat.
Alloy Resembling Hardened Copper	**Cupaloy**	An alloy that can be obtained with elastic strength of 35,000 pounds per square inch and with remarkable heat and electrical conductivity characteristics. Withstands temperatures of 750 degrees F. with relatively little permanent softening. Rate of wear under severe tests is only 40 per cent of that of hard-drawn copper.	Used in making continuous welds that are unusually strong and gas-tight, as in welding streamline trains, cooling systems for electric refrigerators, etc. When used for welding tips, the alloy has a service life from 50 to 200 per cent longer than other low-resistance alloys.
Corrosion-resisting Alloy	**Durco KA2S**	An 18 per cent chromium, 8 per cent nickel, low-carbon steel developed for its corrosion-resisting properties.	Suitable for handling nitric and fruit acids.
Corrosion-resisting Alloy	**Durco KA2SMo**	An 18 per cent chromium, 8 per cent nickel, 3 per cent molybdenum, low-carbon steel developed for its corrosion-resisting properties.	Suitable for handling pulp cooking liquids and phosphoric acid.
Synthetic Plastic	**Durez 38-443**	Asbestos-filled molding material having a compressive strength of 28,000 pounds per square inch and a specific gravity of 1.8.	Developed to meet the Underwriters' specifications for withstanding 200 degrees C. (392 degrees F.) for 72 hours.
Synthetic Plastic	**Durez 38-646**	Asbestos-filled molding compound with unusually low specific gravity—1.59. Compressive strength, 28,000 pounds per square inch; flexural strength, 9000 pounds per square inch.	Suitable for resisting temperatures up to 500 degrees F.
High-impact Plastic	**Durez 1900 Black**	A high-impact phenolic molded material, easily preformed and readily fed through hoppers and automatic feeding devices.	Suitable for production of molded parts that may be subjected to shock.
Phenolic Molding Compound	**Durez 8685**	A material having high resistance to carbonization under an electric arc and that will hold its high dielectric strength when used at moderately high temperatures. It does not crack under expansion and contraction of metal inserts.	Developed especially to prevent "tracking" in cases where there is combined electric spark and rubbing action.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Corrosion-resisting Alloy	**Durimet**	A nickel-chromium-molybdenum low-carbon steel having corrosion-resisting properties for the handling of corrosive liquids.	Used for all parts that come in contact with such corrosive liquids as weak sulphuric and other acids, chlorine bleach solutions, and caustics.
Corrosion- and Wear-resistant Alloy	**Duronze**	An alloy of high resistance to wear and corrosion, composed of aluminum, copper, and silicon, with a tensile strength of 90,000 pounds per square inch.	Developed for the manufacture of valve bushings for valves that must operate at high pressures and high temperatures without lubrication.
High-strength Flat-rolled Steel	**Dyn-El**	A high-strength flat-rolled steel with unusual capacity to resist fatigue, impact, and corrosion. Can be produced at low cost. Permits safe working loads of 25,000 pounds per square inch. Elastic limit, 58,000; tensile strength, 72,000 pounds per square inch; elongation in 2 inches, 28 per cent; and reduction of area, 60 per cent.	Suitable for railroad rolling stock, permitting reduction in dead load at no decrease in strength or service life; for trucks, buses, and other automotive equipment, to obtain reduced weight, with increased strength; and for stationary structures, to obtain increased strength, longer life, and resistance to corrosion.
Brazing Alloy	**Easy-Flo**	A low-temperature brazing alloy having a medium silver content, which produces a high-strength bond with great ductility, making assemblies made with it gas-tight in service.	Suitable for making reliable joints between unlike metals, as, for example, for joining steel, copper, and non-ferrous alloys.
Refractory Furnace Material	**Firecrete, Light-Weight**	A light-weight material from which any refractory shape can be obtained quickly by simply mixing it with water and casting it in a form. After being in the form twenty-four hours, the shape is ready to be placed in service. Sixty-five pounds of material are required for each cubic foot of finished construction.	Suitable where difficult brick construction is encountered, for lining furnace doors, and for making small monolithic linings. Can be subjected to working temperatures up to 2200 degrees F. Especially advantageous in the case of intermittently operated furnaces.
Weld Spatter Prevention Coating	**Flash-Ex**	A metal coating eliminating the necessity of grinding or chipping weld spatter from the metal surrounding a weld. The white and pigmented coating prevents the adhesion of spatter to the welded parts, dies, or welding-holder jaws. After the welding operation, any spatter is merely brushed off.	This metal coating is used in resistance welding to prevent the dies and welding-holder jaws from becoming jammed due to spatter.
Magnet Wire	**Formex**	Magnet wire insulated with a synthetic resin which is tougher and more flexible than ordinary enamel coatings and which takes up much less space. The electrical properties are as good as those of ordinary enameled wires, with higher resistance to abrasion. When severely twisted and then subjected to a temperature of 260 degrees F. for one hour, ordinary enameled wire cracks, while Formex wire is not affected.	This new type of insulation has been found to have improved qualities in the actual manufacture of many electrical products. It gives the designer an opportunity to reduce the size of many products of which this wire is an integral part.
Packing Lubricant	**Formula No. 610725**	A compound that provides durable lubrication and makes an effective seal with assurance against possible scoring. It forms an actual metallic surface, which quickly attains a polish or glaze when in contact with a moving member. Suitable for all pressures and for temperatures up to 1000 degrees F.	Intended for application to exterior surfaces in all types of packing prior to installation and to stuffing boxes after installation.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Cleaning Compound	**Galvo-Cleen**	This compound forms a bond that enables newly galvanized metal to be painted without a primer, the compound providing a non-reactive zinc-phosphate coating.	Galvanized metal, zinc die-castings, and alloys having a large percentage of zinc can be cleaned and prepared for painting by applying this compound.
Powdered-metal Contacts	**Gibsiloy**	Eight grades of nickel-silver, silver-nickel-tungsten, silver-nickel-molybdenum and silver-nickel-cadmium powdered-metal compositions which can be produced in button, wire, strip, or rod form.	Can be headed into rivets or buttons for electrical contacts or coined to any shape required.
Sealing Compound	**Glycoseal**	A flexible, leakproof, and non-cracking compound that can be used on rubber as well as on metals. As it will not harden, joints once formed can be broken readily without damage to fittings.	Useful as a sealing compound for joints in pipes and containers carrying propane, pentane, butene, benzol, gasoline, naphtha, grease, and oils of all types.
Ferro Alloys	**Grainal**	These alloys are used to produce desirable properties in steel. One contains 25 per cent vanadium, 15 per cent titanium, and 10 per cent aluminum; another contains 13 per cent vanadium, 20 per cent titanium, and 12 per cent aluminum; while a third contains 20 per cent titanium, 20 per cent aluminum, and 6 per cent zirconium.	They make possible the production of steel of uniform properties from heat to heat; the conversion of some water-hardening steels into oil-hardening; the production of steel of unusual physical properties at economical cost; and the addition of alloys to steel without complicating the usual steel making processes.
Welding Rod	**Haynes 93**	An alloying rod for hard-surfacing wearing parts. It has a tensile strength of about 43,000 pounds per square inch and a hardness (as deposited by oxy-acetylene welding) of 62 Rockwell C. When properly heat-treated, the hardness may be increased to 66 or 67 Rockwell C.	Successfully used on dredge pump impellers, cement-clinker crusher rolls, tamper feet for cinder block manufacturing, tube-bending mandrels, farm implements, and other parts where severe abrasion and moderate impact are encountered.
Nickel-chromium Alloy	**Illium-R**	A corrosion-resistant alloy from which strip, welded tubing, and cold-rolled rods are produced having, when work-hardened, a tensile strength ranging from 140,000 to 150,000 pounds per square inch. In an annealed condition, the tensile strength is from 95,000 to 105,000 pounds per square inch. Brinell hardness, work-hardened, from 340 to 365; annealed, from 175 to 240. Has approximately the same machinability as stainless steel.	Strip stock of Illium-R is available in a number of widths and lengths and in gages from 8 to 34; adapted for drawing, perforating, stamping, and other fabrication methods. Rolled rod is suitable for tie-rods, light shafting, screw machine stock, and small hardware.
Non-magnetic Steel	**Jessop Non-magnetic Steel**	A free-machining alloy steel having a magnetic permeability of from 1.003 to 1.006 at 1000 oersteds magnetizing force at temperatures from sub-zero to boiling. Tensile strength, from 80,000 to 110,000 pounds per square inch; yield point, 35,000 to 60,000 pounds per square inch; elongation in 2 inches, 25 to 50 per cent.	Suitable for use in transformer, switch, and controller covers, entrance plates, spacing bars, end fingers, and numerous other parts of electrical equipment.
Enamels for Plastics	**Kem Bakolescent** **Kem Plastite**	An enamel applicable to plastic surfaces. Available in iridescent form (Kem Bakolescent) or in solid colors (Kem Plastite). Applied by either dipping or spraying	Useful in dressing up molded parts for vacuum cleaners, electrical wiring devices, radio cabinets, automobile parts, etc.
Wear-resisting Alloy	**Kennametal**	A tungsten-titanium-carbide compound having great wear and corrosion resistance and strength. In one instance, where it was previously necessary to change as many as seven valves in twenty-four hours, when Kennametal-tipped valves and seats were used, only one valve had to be replaced every one or two weeks.	Suitable for pump and other valves that are subject to unusual abrasive or corrosive action. Its wear resisting properties make it applicable for dies, plug gages, follow-rests, drill jig bushings, etc.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Synthetic Rubber	**Liberty**	A synthetic rubber produced from petroleum, natural gas, air and other natural materials. Does not swell or lose tensile strength when exposed to gasoline or mineral and vegetable oils.	Has proved preferable to natural rubber for gasoline hose and airplane expander tube brakes. Has also been used satisfactorily for automobile tires.
Metal-faced "Lumber"	**Ludlite Bord**	A structural material composed of inert mineral backing, permanently bonded to a stainless-steel facing. This material can be sawed like lumber, sheared like sheet metal, and drilled as readily as hard wood.	For structural use wherever surface requirements call for a relatively inexpensive form of stainless steel.
High-strength Cast Iron	**Meehanite, Super A**	High-grade cast iron in which copper is used as an alloy metal, developed to provide a great increase in hardness and wearing qualities, while at the same time being easily machinable. Super A Meehanite with a hardness of 269 Brinell can be machined 20 per cent faster than regular alloy cast iron of 207 Brinell. Tensile strength, over 50,000 pounds per square inch.	Particularly well adapted for use in the construction of internal combustion engines and marine cylinders; also used in the manufacture of large gears, piston-rings, and other parts subjected to severe wear.
High-strength Cast-Iron	**Meehanite, Super WH**	An alloy that is unusually wear-resistant and that has a well balanced combination of physical properties. Can be made with a hardness up to 578 Brinell.	This type of Meehanite cast iron has been found especially suitable for castings subjected to extremely severe wear, such as ball-mill liners, muller tires, and pan bottoms.
Paste Solder	**Meltomatic**	A paste solder that can be brushed on any metal and heated by any means to its melting temperature, which is slightly above 400 degrees F. No preliminary cleaning or tinning operations are necessary.	Especially applicable where soldering irons are difficult to use, as in inaccessible spaces and on small parts.
Protective Metal Coating	**Metaseal 494**	A protective, invisible, transparent coating that can be applied by dipping, spraying, or brushing without special equipment.	Useful as a rust-preventive for steel, brass, and other metals.
Rubber Lining for Tanks	**Multi-Ply**	Liquid rubber which is applied in laminations to the sides of metal tanks to be coated until the desired thickness is obtained. These several coats coalesce during the vulcanizing process into a single sheet, bonded or almost "welded" to the walls of the tank.	Especially applicable to plating and chemical tanks. Provides a continuous, seamless, lap-free, and unbroken lining.
Nickel-iron Alloy	**Nilvar**	A nickel-iron alloy that has the lowest coefficient of expansion of any metal at temperatures up to 392 degrees F.	Suitable for applications where dimensions must be maintained at varying temperatures, as, for example, in rotor and stator plates of variable condensers in ultra high-frequency radio equipment, bimetallic strip, etc.
Light-weight Alloy	**No. 301**	This alloy is 66 per cent lighter than steel or iron; rustproof; non-magnetic; and has good forming, drawing, and electrical conductivity properties. Its ultimate tensile strength is 72,000 pounds per square inch; elongation in 2 inches, 32 per cent; yield point, 57,500 pounds per square inch; and hardness, 109 Brinell. Available in sheet, plate, rod, bar, wire, pipe, tubing, and extruded forms.	This is a readily fabricated structural material which lends itself to gas welding, arc welding, spot welding, brazing, soldering, chemical fusion welding and reaction soldering.
Pulley Covering	**Nonslip**	A sheet material that is wrapped around pulleys to prevent slip. Furnished in sheets of 9 square feet which are cut into strips of proper width.	A single application eliminates belt slippage for a period, usually, of two years.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Pickling Agent	**Pickleen**	A liquid wetting and penetrating agent which, when added to sulphuric or hydrochloric acid pickling solutions, reduces their surface tension and gives them greater wetting and penetrating action. It is added in the proportion of one pint to about fifty gallons of acid solution. It is non-inflammable, almost odorless, and harmless to the skin.	Used in pickling solutions for cleaning rust or scale; in acid dips before plating to insure clean work and to prevent peeling or blistering; for pickles employed previous to hot-galvanizing, hot-tinning, rustproofing, painting, etc.
Baking Enamel	**Platelustre (Baking)**	A baking enamel by means of which any polished metal can be made to resemble brass, aluminum, or steel. Flat stock finished with the enamel can be formed after baking. The enamel can be applied to polished metal by spraying or roller-coating.	Especially suitable for use in the manufacture of lighting fixtures, compacts, novelties, and other products on which a brilliant metallic finish is desirable.
Metal Finish	**Polymerin-100**	A finish with excellent qualities of corrosion resistance and durability, combined with film hardness, luster, adhesion, toughness, and color retention.	For use where low-temperature, high-speed baking characteristics are important.
Gray Cast Iron	**Pomoloy**	An unalloyed cast iron having a tensile strength of 40,000 pounds per square inch and a hardness of 215 Brinell; it is dense and corrosion-resistant. The high physical properties are obtained by a careful control of the materials used and of the foundry processes rather than by the addition of alloys. Pomoloy is easily machined. The machined surfaces can be highly polished and the iron can be hardened by heat-treating methods and by the oxy-acetylene process.	This cast iron is now used in pump manufacture, but is applicable wherever a high-grade plain gray iron of high tensile strength serves the purpose.
Waterproof Paint	**Porce-Tite**	A white waterproof paint that can be used in any consistency from that of a cement-like compound for filling cracks and crevices, to that of a free flowing paint. The paint sets in about three hours, hardens in twenty-four hours, and requires about five days to cure thoroughly. Any paint, calcimine, or casein can be applied over it.	May be applied to cement, concrete, brick, stucco, clay tile, stone, asbestos sidings, and plaster board, but not to wood, plaster, metal, nor oil-painted or oil-spotted surfaces.
Protective Metal Compound	**Protect-O-Metal**	Protective compound, resistant to heat, for use in welding and die-casting. Can be sprayed or brushed on metal. When sprayed on a die-casting die, it serves as a protective coating for at least twenty-five successive castings.	Used to prevent corrosion and the collection of spatter on metal surfaces during welding. Prevents castings from sticking to die molds. Also forms suitable priming coat for paint.
Metal Cleaner	**Quaker TF-936**	A water-soluble hydrocarbon for use in cleaning metals. Particularly effective for removing mineral oils, fatty substances, and soap.	Compound can be used for removing all types of cutting, slushing, and quenching oils from machine parts. Also serves to rustproof work for a short period of time.
Belt Coating	**R-60-T**	A synthetic coating which can be brushed on belts of all types. Samples of belting, when so coated and placed under severe tension, have shown no evidence of deterioration after six months' exposure to all kinds of weather.	Particularly useful for protection of outdoor conveyor belting from deterioration through action of sunlight and air, especially during idle periods.
Flexible Tubing	**Resistoflex**	Tubing made in sizes up to and including 1/2 inch inside diameter, from a flexible synthetic resin, insoluble in gasoline, oil, ether, and alcohol. Has extreme lightness (weight about one-half that of aluminum), great toughness and strength, good elasticity, and a high degree of flexibility.	Used chiefly in fuel and brake lines; in lubrication systems for automotive equipment, Diesel engines, and aircraft; in chemical and process industries for conveying solvents and oils; and in hydraulic lines.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Protective Coating	**Seal-Cote**	A transparent protective metal coating that withstands the action of sunlight, moisture, and climatic changes. The coating can be spread or brushed on the metal surface. It is claimed to have preserved the original finish of metal parts when exposed to weather for a period of six months.	Recommended for use on copper, brass, bronze, and steel, as well as on other metals subjected to outdoor exposure, moisture, etc.
Stainless-steel Clad Sheets	**Silver-Ply**	Mild steel sheets and plates of flange quality, bonded with stainless steel of 3 to 50 per cent of the total thickness. These sheets can be bent, spun into deep heads, deep-drawn, drilled, and otherwise worked with greater ease than solid stainless steel.	Useful for manufacture of cooking vessels, storage tanks, marine equipment, and other applications where corrosion and erosion is a problem.
Powdered Metal	**Sinterloy**	A powdered metal that can be pressed into practically any shape and sintered to produce a dense, homogeneous steel. The forming pressure is 50 tons per square inch, and sintering is usually accomplished at 1965 to 2100 degrees F.	Suitable for production of such parts as gears, cams, pump rotors, washers, pins, rivets, and splined shafts. It is said to compare well with cast steel and cast alloy steel.
Weld Spatter Prevention Coating	**Spatter-Ex**	A metal coating to obviate the grinding or chipping of weld spatter from the metal surrounding a weld. The transparent jelly-like coating prevents the adhesion of spatter. After the welding operations have been completed, any spatter on the surrounding surfaces is merely brushed off.	The compound is especially applicable to arc-, flash-, or butt-welding operations.
Metal Adhesive	**Strangl-Hold**	A two-element adhesive consisting of a powder and a liquid which are mixed shortly before using. A metal-to-metal joint, 3 by 3 inches square, will support approximately 1350 pounds. A glass-to-metal joint of the same size will support up to 1650 pounds. The adhesive is unaffected by many corrosives, but is attacked by rubber solvents and by copper and manganese in solution.	Suitable for joining metal to metal, glass, wood, or other materials, glass to glass, wood to wood or glass. It also makes an excellent coating for protecting metals of all kinds against atmospheric and other forms of corrosion.
Die Material	**Strenes Metal**	A chromium-nickel-molybdenum alloy that can be cast to shape, eliminating a large amount of machine work and stock removal. Up to 500 hours of machining time has been saved by the use of this metal for a single large die. In the plant of a refrigerator manufacturer, dies from this metal are said to have produced more than 1,350,000 refrigerator top stampings from 0.050-inch material.	Suitable for drawing and forming dies, punches, forming pads, and draw- or pressure-rings.
Wear and Rust Prevention Coating	**Thermoil-Granodine**	A coating material developed to prevent wear and rust of machine parts. Applied by immersing the machine parts, after thorough cleaning, in a boiling solution of the coating material. The solution transforms the surface into a layer of iron and manganese phosphates, which becomes an integral part of the metal beneath.	Suitable for treating automobile engine parts, such as pistons, valves, and camshafts; gears; and any machine parts having bearing surfaces.
Floor Covering and Filler	**Tred Seal**	A liquid covering that can be applied to floors with a steel trowel for surface protection, and is ready for heavy service six hours after application.	Prepared as a waterproofing, crack-filling, and splinter-proofing material for wood or concrete floors.
Copper Alloy	**Trodaloy**	A copper alloy containing beryllium and chromium, which is much harder and tougher than copper. Particularly useful in withstanding the high pressures and impacts encountered in welding processes.	Useful for welding electrodes, switch plates, cams, spring fingers, and mechanical parts requiring high electrical conductivity.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Magnetic Alloy	**Vicalloy**	An alloy composed of cobalt, vanadium, and iron that can be made to hold more permanent magnetism than any commercial material previously developed. It can be drawn and rolled without losing its magnetism.	This alloy has been applied in the form of a tape for sound recording purposes.
Rolled Zinc	**Zilloy**	A rolled zinc possessing greater strength than heretofore available in commercial grades. It is stiffer and stronger, and has greater heat resistance than the commercial grades of rolled zinc, but possesses the same corrosion-resistant characteristics. Fabricated and finished by similar methods to those used for commercial grades.	Suitable for fabrication into screen frames, screen guides, splines, weather-strips, corner beadings and moldings, as well as for zinc stampings of greater strength than obtainable from commercial grades of rolled zinc.
Compound Applied before Lacquering or Enameling	**Zinsol**	A solution or compound which, when applied to metal surfaces, forms a surface that is chemically inert to moisture, the atmosphere, and organic finishes, so as to form a stable foundation for any desired finish.	Used for treating the surfaces of zinc, zinc-coated, or galvanized products before finishing them with lacquer, enamel, paint, or varnish. The zinc products are dipped into or wiped with the solution.
Nickel Alloy	**Z-Nickel**	A nickel alloy containing 98 per cent nickel, which has the corrosion-resistant properties of nickel combined with the mechanical properties of high-strength alloy steel. It has been produced with a tensile strength as high as 250,000 pounds per square inch, and a hardness as high as 46 Rockwell C. Commercial cold-rolled strip, unhardened, varies in tensile strength from 90,000 to 155,000 pounds per square inch, and heat-treated strip from 120,000 to 220,000 pounds per square inch.	Has been applied to the manufacture of hand tools, wire brushes, spring clamps, helical springs, and electrical parts. It is commercially produced in the form of hot- or cold-rolled strip.

Shell Production Meeting of the A.S.M.E.

UNDER the auspices of the Machine Shop Practice Division, the Metals Engineering Division, and the Pittsburgh Section of the American Society of Mechanical Engineers, a meeting on shell production was held September 11 at the William Penn Hotel, Pittsburgh, Pa., at which about two hundred and fifty people interested in shell manufacture were present. Included in this number were numerous officers of the U. S. Army, engineers and manufacturers who are engaged in shell manufacture or who are planning to bid for Government contracts for shells, as well as forging machine and machine tool manufacturers who have developed equipment suitable for shell forging and machining.

In addition to numerous extemporaneous addresses and contributions to the discussion of the various subjects involved, the following papers were presented: "Hydraulic and Mechanical Methods of Forging Shells," by Frederick G. Schranz, general manager, Baldwin-Southwark Division, Baldwin Locomotive Works, Eddystone, Pa.; "Forging Machine Methods of Making Shells," by J. H. Friedman, vice-president, National Machinery Co., Tiffin, Ohio; "Shell Machining Methods at Frankford Arsenal," by Major E. C. Bomar, U. S. Army, Frankford Arsenal, Philadelphia, Pa.; "Modern Methods of Shell Machining," by E. P. Blanchard, sales manager, Bullard Co., Bridgeport, Conn.; "Machining Shells by Centerless Grinding," by Lincoln Melhope, engineer, Cincinnati Milling Machine Co., Cincinnati, Ohio; and "Should Shell Cavities be Forge Finished?" by Lucien I. Yeomans, Chicago, Ill.

Unusual interest was shown in all the subjects presented and numerous questions pertaining to shell manufacture were asked of the authors and of the officers of the Ordnance Department and of the Frankford Arsenal. Another meeting along similar lines is planned to be held at the Hotel Gibson, Cincinnati, Ohio, October 16 and 17.

New Method of Hardening High-Speed Steel

A method of hardening high-speed steel has been developed by the Perfection Tool & Metal Heat Treating Co., Chicago, Ill., which is claimed to result in twice the normal toughness, combined with a hardness of 65-66 Rockwell C. This method of hardening, which has been designated "Nusite," is intended to produce tools that will fill a gap between high-speed tools hardened in the ordinary way and carbide tools. It is claimed that a "Nusite" hardened tool, when used on a steel-cutting job, will result in at least one or more of the following improvements: Increased cuts, increased feeds, longer runs between grinds, ability to cut tougher steel, ability to make intermittent cuts, reduction of chipping and breakage, and some increase in speed. The company is prepared to supply tools that have been hardened by this method and to treat special types of high-speed tools for the trade.

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 157 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the October Number of MACHINERY

High-Speed Production Tools

ILLINOIS TOOL WORKS, 2505 N. Keeler Ave., Chicago, Ill. Catalogue E (292-page engineering handbook) on high-speed production tools, covering hobs, shaper cutters, gear-cutters, milling cutters, broaches, ground form tools, and special tools. An engineering data section, of value to tool designers, users, and buyers, is included. The book is available only to production men and tool buyers who send in a request on their company letter-head. 1

Electrical Equipment

OHMITE MFG. CO., 4835-55 W. Flournoy St., Chicago, Ill. 96-page catalogue No. 40, 8 1/2 by 11 inches, containing a great many helpful facts, engineering data, reference tables, dimensioned drawings, etc., for the selection and application of resistors, rheostats, tap switches, chokes, and attenuators. 2

Polishing and Buffing Lathes

ROME MACHINERY SALES & ENGINEERING CO., 627 Webster St., Rome, N. Y. Catalogue sheets Nos. 30, 32, 34, and 36, illustrating and describing single-spindle and double-spindle models of the line of electrically driven polishing and buffing lathes made by this concern. 3

Milling Machines

U. S. TOOL COMPANY, INC., Ampere (East Orange), N. J. Bulletin 40, on the application of Multi-Millers to the continuous milling of formed stock, rotary milling, automatic cut-off operations, automatic indexing, vertical milling, and high-speed grinding. 4

Hydraulic Presses

CLEARING MACHINE CORPORATION, 6499 W. 65th St., Chicago, Ill. Catalogue describing a few of the many types of Clearing hydraulic precision presses—their applications, operating advantages, design and construction, capacities and sizes. 5

Salvaged Tools

RUTLAND TOOL SALVAGE CO., 227 Adelaide St., Detroit, Mich. Folder entitled "Converting Old Tools into New," describing a service offered by the concern in restoring worn or broken end-mills, reamers, and milling cutters. 6

Hoists and Cranes

CHISHOLM-MOORE HOIST CORPORATION, Tonawanda, N. Y. Catalogue 122A, on electric and hand power hoists, as well as all types of cranes and trolleys, containing complete information on features of construction, sizes, capacities, prices, etc. 7

Multiple Tool-Room Machine

HACK MACHINE CO., 440 N. Oakley Blvd., Chicago, Ill. Catalogue illustrating and describing the Hack Multi-Versal, a universal machine tool for tool-room use, capable of performing thirty different operations. 8

Non-Shrinkable Tool and Die Steel

JESSOP STEEL CO., 605 Green St., Washington, Pa. Folder descriptive of "Truform," an oil-hardening, non-shrinkable, alloy steel for use in tools and dies where extreme accuracy is required. 9

Electronic Devices

GENERAL ELECTRIC CO., Schenectady, N. Y. Circular GES-2411, containing a brief outline of typical uses of various types of electronic tubes in industry, through which routine manual control is obviated. 10

Industrial Lighting

FOSTORIA PRESSED STEEL CORPORATION, Fostoria, Ohio. Catalogue ML-25, entitled "Lighting for Seeing on the Job," dealing with lighting brackets and fixtures permitting of proper localized lighting. 11

Mechanical Cutting Pliers

WM. SCHOLLHORN CO., New Haven, Conn. Circular illustrating and describing the Bernard mechanical cutting pliers with "gorilla grip," which have many new features not usually found in such tools. 12

Broaching Machines

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio. Catalogue M-886, on single-ram vertical Hydro-Broach machines; and M-894, on duplex vertical Hydro-Broach machines. 13

Turret Lathes

GISHOLT MACHINE CO., 1209 E. Washington Ave., Madison, Wis. Data Sheets Nos. 54, 56, and 57, on the economical machining of flywheels, stoker bearing cases, and compressor parts. 14

Ball-Bearing Lubrication

NEW DEPARTURE DIVISION GENERAL MOTORS SALES CORPORATION, Bristol, Conn. 15-page booklet covering the selection of oils and greases for ball bearings and their application. 15

Welding Machines

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Leaflet 26-325, descriptive of the Type WT-4 portable, alternating-current welder designed for general-utility service and production welding. 16

Aero Screw-Thread System

AIRCRAFT SCREW PRODUCTS CO., INC., 25 Forty-first Ave., Long Island City, N. Y. Bulletin T-1a, containing engineering standards and technical information on the aero-thread screw thread system. 17

Honing Machines

MICROMATIC HONE CORPORATION, 1345 E. Milwaukee Ave., Detroit, Mich. Catalogue showing numerous

examples of microfinished aircraft parts. Operation and production data are included. 18

Lower-Priced Kennametal Tools

McKENNA METALS Co., 147 Lloyd Ave., Latrobe, Pa. Price list No. 4 containing new low prices on standard Kennametal steel-cutting tools and blanks. Savings up to 60 per cent are announced on these tools. 19

Die Steels

ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Bldg., Pittsburgh, Pa. Booklet entitled "When It Comes to Die Steels, I am Hard to Convince," giving detailed information on steel for dies. 20

Aluminum Pistons and Cylinder Heads

ALUMINUM CO. OF AMERICA, Pittsburgh, Pa. Catalogue on aluminum pistons and aluminum cylinder heads, describing the types of pistons, materials used, and finishes. 21

Buffing and Polishing Machine with Infinitely Variable Speed

STANDARD ELECTRICAL TOOL CO., 1948 W. 8th St., Cincinnati, Ohio. Bulletin 38-A, describing a new infinitely-variable-speed buffing and polishing machine. 22

Grinding Wheels

ABRASIVE CO., Tacony and Fraley Sts., Philadelphia, Pa. Grinding wheel data book, of 112 pages, with complete information on the manufacture, use, and application of grinding wheels. 23

Presses, Bulldozers, and Tube Benders

WILLIAMS, WHITE & Co., Moline, Ill. Catalogue on tube and bar benders, bulldozers, presses, punches, rolls, shears, and forging and riveting hammers. 24

Twin Broaching Machines

OILGEAR Co., 1315A W. Bruce St., Milwaukee, Wis. Bulletin 21000, illustrating and describing a new "Twin-12" horizontal broaching machine for high-speed internal and external broaching. 25

Optical Shop Equipment

BAUSCH & LOMB OPTICAL Co., Rochester, N. Y. Catalogue D-22, on toolmakers' microscopes, binocular microscopes, shop microscopes, and optical flats, drill gages, and protractors. 26

Materials-Handling Chain

COLUMBUS-McKINNON CHAIN CORPORATION, 122 Freemont Ave., Tonawanda, N. Y. Industrial chain catalogue 122, containing technical information on welded-steel chain. 27

Flexible Couplings

AJAX FLEXIBLE COUPLING Co., Westfield, N. Y. 20-page handbook for design and maintenance engineers, on the application of forged-steel and cast-iron couplings. 28

Pulleys, Pillow Blocks, Couplings, Etc.

BOSTON GEAR WORKS, INC., North Quincy, Mass. Hardware products catalogue, containing data on pulleys, pillow blocks, shaft supports, and couplings. 29

Herringbone Gear Reducers

LINK-BELT Co., 307 N. Michigan Ave., Chicago, Ill. Book 1519-A, on the company's complete line of herringbone gear reducers, giving horsepower ratings and dimensions. 30

Prefinished Metals

AMERICAN NICKELOID Co., Peru, Ill. Series of circulars describing how prefinished metals have helped manufacturers in various lines to reduce costs. 31

Tapping Machines

CLEVELAND TAPPING MACHINE Co., Cleveland, Ohio. Catalogue illustrating and describing the Cleveland B-2 vertical automatic tapping machine, designed for high production. 32

Portable Acetylene Generators

MARQUETTE MFG. Co., INC., Minneapolis, Minn. Circular illustrating and describing portable acetylene generators having many new features. 33

To Obtain Copies of New Trade Literature

listed on pages 156-158 (without charge or obligation), mark with X in the squares below, the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

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Precision Lathes

HARDINGE BROTHERS, INC., Elmira, N. Y. Catalogue illustrating and describing the features of construction of the new Hardinge high-speed precision lathe. 34

Steels for Plastic Molding

CRUCIBLE STEEL CO. OF AMERICA, 405 Lexington Ave., New York City. Folder containing a handy guide for selecting the right steels for plastic molding. 35

Electric Equipment

WESTINGHOUSE ELECTRIC & MFG. Co., East Pittsburgh, Pa. Leaflet 3105, illustrating and describing dual-ventilated, fan-cooled, Type CS squirrel-cage motors. 36

Industrial Cleaning Equipment

PANGBORN CORPORATION, Hagerstown, Md. Folders entitled "Better Cleaning at Lower Cost," and "Five Questions on Industrial Cleaning." 37

Spot-Welders

ACME ELECTRIC WELDER CO., Huntington Park, Calif. Bulletin 51, illustrating and describing Acme foot-operated spot-welders. 38

Oil-Retaining Bearings

BOUND BROOK OIL-LESS BEARING CO., Bound Brook, N. J. Stock List No. 1, on "Compo" oil-retaining porous bronze bearings. 39

Chaser Grinder

GEOMETRIC TOOL CO., New Haven, Conn. Bulletin 1, illustrating and describing the new Geometric single-purpose chaser grinder. 40

Stainless-Steel Tubing

J. BISHOP & CO. PLATINUM WORKS, Malvern, Pa. Folder on stainless-steel seamless tubing from 0.008 to 1 inch outside diameter. 41

Upright Drilling Machines

BUFFALO FORGE CO., Buffalo, N. Y. Bulletin 2989-D, illustrating and describing the Buffalo No. 22 upright drilling machine. 42

Furnace Elements

HEVI DUTY ELECTRIC CO., Milwaukee, Wis. Bulletin HD-740, on Hevi Duty furnace radiant heat element construction. 43

Transmission Belting

B. F. GOODRICH CO., Akron, Ohio. 4-page catalogue section on "Highflex" and other types of transmission belting. 44

Packings

WAYNE DAVIES PACKINGS, INC., 325 W. Huron St., Chicago, Ill. Bulletin on Davies new type double "U" packings. 45

Air Hose

SULLIVAN MACHINERY CO., Michigan City, Ind. Bulletin 87-Z, on air hose for use with pneumatic tools of all kinds. 46

Punching and Notching Machines

STRIPPIT CORPORATION, Buffalo, N. Y. Booklet entitled "The Punching and Notching of Stove Panels." 47

Drafting-Room Equipment

OZALID CORPORATION, Johnson City, N. Y. Bulletin 187, on fast-printing whiteprint machines. 48

Metal Stampings

DAYTON ROGERS MFG. CO., 2830 S. 13th Ave., Minneapolis, Minn. Folder on metal stampings in small lots. 49

Texrope Drives

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Bulletin B-6051-A, on Allis-Chalmers Texrope Drives 50

Flame-Hardening Equipment

AIR REDUCTION SALES CO., 60 E. 42nd St., New York City. Bulletin on flame-hardening apparatus. 50-A

Industrial Goggles

DOCKSON CORPORATION, 3839 Wabash Ave., Chicago, Ill. Leaflet on "Monelite" goggles. 50-B

Slide-Rules

KEUFFEL & ESSER CO., Hoboken, N. J. 24-page booklet on how to choose a slide-rule. 50-C

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 159-173 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment mark with X in the squares below, the identifying number found at the end of each description on pages 159-173 — or write directly to the manufacturer, mentioning machine as described in October MACHINERY.

51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94

Fill in your name and address on other side of this blank.

Detach and Mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

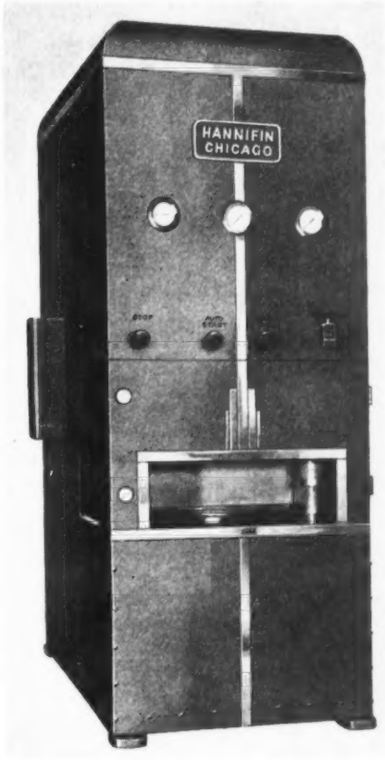
Hannifin Centrifugal Quenching Machine

A quenching machine that employs centrifugal force to apply the coolant in such a manner as to reduce distortion of circular or disk-shaped parts has been developed by the Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill. It is designed to apply a large volume of quenching fluid at a uniform, controlled temperature. The centrifugal force causes the quenching fluid to be distributed around the work in the form of a ring, the central hole of which is closed up quickly to obtain uniform quenching with minimum distortion. The new machine is adapted for quenching a wide variety of parts, including disks, flat cams, rings, bearing races, and similar work.

The heated part, such as the gear indicated in cross-section in Fig. 1, is placed on the lower fixture in the machine. The insertion and removal of the work at the end of the automatic cycle of operation is the only handling required. The upper and lower holding fixtures are designed to meet individual requirements of the part to be quenched. A mandrel for centering may be provided, and a certain amount of control of the quenching action may be obtained when desirable, through the design of suitable fixtures. The holding fixtures are automatically operated, and in closing, provide a mechanical straightening effect or alignment of the hot part. Referring to Fig. 2, it will be noted that the hub of the gear, located by a pin on the lower part of the fixture, is held in place by a plunger in the upper fixture, and that pins in both the upper and lower fixtures clamp or hold the rim of the gear against warping.

The upper holding fixture is surrounded by a circular quenching chamber, as shown in Figs. 1 and 5, which, when brought down over the work, provides a circular container for the quenching fluid, as shown in Fig. 2. When in the closed position, the entire assembly of quenching chamber, holding fixture, and hot part is rotated by means of a motor drive. The quenching fluid is introduced at the outer edge of the revolving container, as shown in Fig. 3.

The oil is introduced in controlled volume and at a uniform and accurately controlled temperature. The rotation and the control of the coolant volume produce a revolving "doughnut" or ring of quenching oil around the circumference of the chamber, as indicated diagrammatically in Fig. 6. As the volume of oil is increased, the hole in the ring of oil contracts or is reduced, as shown in Fig. 4, the quenching action or effect having advanced rapidly from the circumference of the part inward or toward the center. The oil flows out of the revolving container, under controlled conditions, so that uniformity of temperature is maintained by fresh oil.



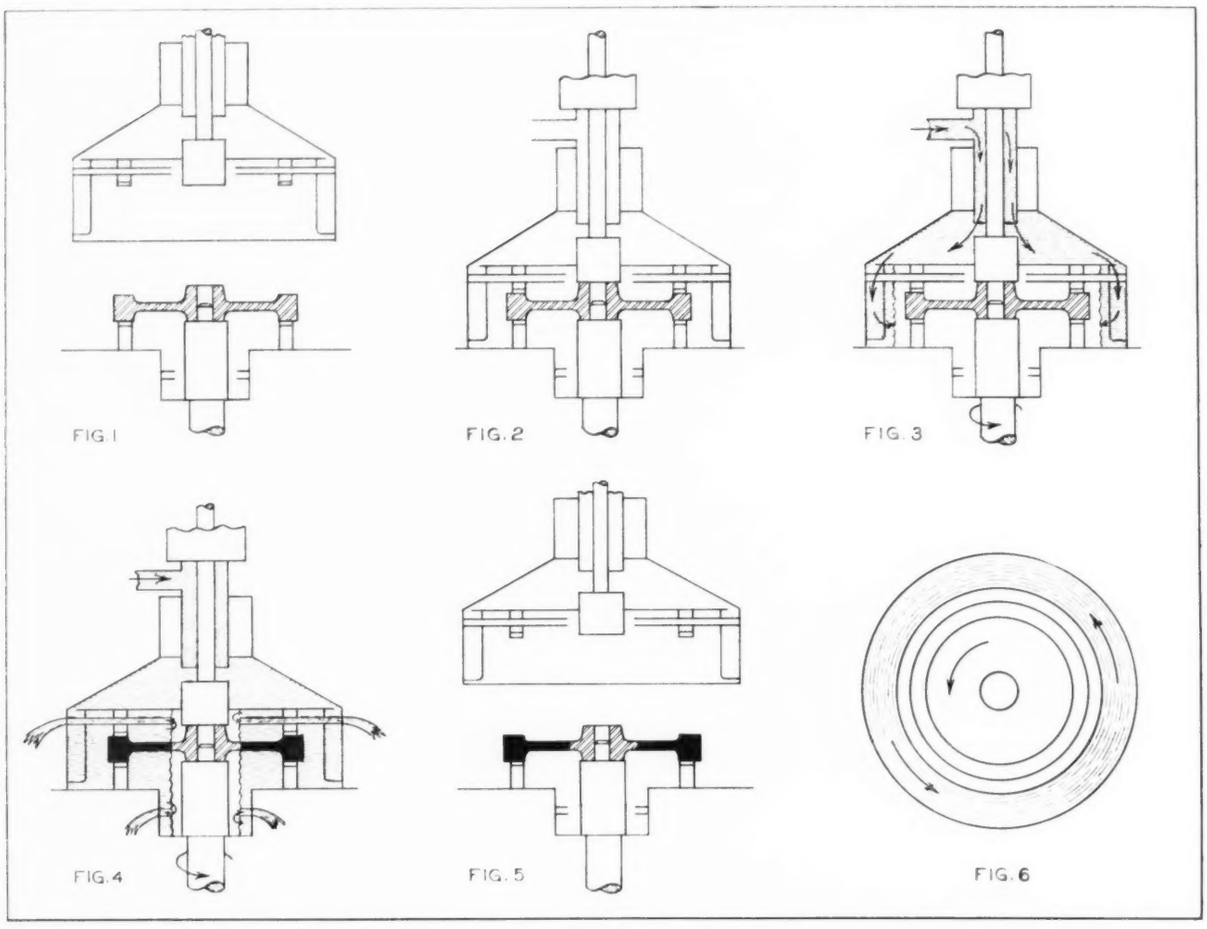
Centrifugal Quenching Machine Brought out by the Hannifin Mfg. Co.

Centrifugal quenching in the manner described not only avoids distortion of circular parts, but also allows control of the rate and degree of quenching. The operating cycle is automatically controlled, with uniform timing, and can be adjusted to furnish the desired timing for handling parts of various types. Sectional quenching under controlled conditions is easily obtained, allowing the center of the part to remain hot and unquenched, as indicated by the cross-sectioned hub of the gear shown in Fig. 4. The quenched part of this gear, shown in solid black in both Figs. 4 and 5, is hardened, while the hub portion, shown in cross-section, remains soft.

The complete cycle of automatic quenching is completed in from 40 to 60 seconds in the case of ordinary gears and sprockets. This rapid quenching speed, under controlled conditions, not only reduces labor and increases production in the quenching operation itself, but also results in a higher quality product.

In handling transmission and crown gears, this method of quenching prevents distortion, and also allows subsequent broaching of the center with the gear chucked on the pitch diameter. On tractor track type sprockets, sectional quenching, which gave localized hardness without distortion, increased production on subsequent finish-machining of the centers from four pieces per hour to twelve pieces per hour. Centrifugal quenching machines of the type described are being used in the

To obtain additional information on equipment described on this page, see lower part of page 158.



Diagrams Illustrating Application of Hannifin Centrifugal Quenching Machine to the Hardening of Gears, the Chief Purpose of which is to Eliminate Distortion

heat-treating of many different kinds of gears, tractor sprockets, tractor transmission gears, circular cams, etc. Some of the most important advantages obtained by the use of the centrifugal quenching machine may be summarized as follows: Correction of mechanical alignment when hot, with adjustable pressures on fixtures to give flattening and rounding effect as desired; control of time of quenching operation; control of volume of quenching medium; and control of temperature of quenching medium as the quenching operation progresses. 51

Photoswitch Short-Interval Timer

A Photoswitch electronic timer designated as Type T15, which is designed for use as a universal interval timer, has been placed on the market by Photoswitch Incorporated, 21 Chestnut St., Cambridge, Mass. This timer is extremely accurate over ranges from one-twentieth of a second to two minutes. Control is accomplished through a specially designed snap-action relay of 1000 watts capacity. The equipment is flexible with respect to actuating control, permitting both momentary push-button and sustaining contact control. It is universal for six timing ranges represented by timing valves snapped into a readily accessible clip. 52

Chicago Pneumatic Portable Reversible Wrenches

Three new sizes of pneumatic reversible wrenches with bolt-size capacities of 3/8, 5/8, and 3/4 inch, respectively, have been brought out by the Chicago Pneumatic Tool Co., 6 E. 44th St., New York City. These three wrenches are practically alike in construction, except that they vary somewhat in size and weight. They are particularly adapted for use where nuts must be applied or removed quickly.

The 3/8-inch Type 344-R wrench has an over-all length of 6 1/2 inches and a spindle offset of 1 3/8 inches. Its net weight is 4 1/4 pounds. The 5/8-inch Type 349-R wrench has an over-all length of 9 3/4 inches, a spindle offset of 1 5/8 inches, and weighs 9 1/2 pounds. The Type 360-R wrench, with a capacity for handling hexagonal nuts for 3/4-inch bolts, has an over-all length of 10 inches, a spindle offset of 1 3/4 inches, and weighs 13 pounds. 53

Colonial "Senior" Line of Presses

A line of general-purpose, hydraulic presses designed for such operations as assembling, broaching, etc., has just been brought out by the Colonial Broach Co., 147 Jos. Campau Ave., Detroit, Mich. These "Senior" presses supplement the "Junior" line of lighter duty presses previously

To obtain additional information on equipment described on this page, see lower part of page 158.

brought out by this company. The new machines are designed for maximum flexibility of operation, regardless of the type of work for which they are employed.

The motor is located within the column. The open-side, fixed table permits working on long parts, as in straightening or assembly work. The press is designed to accommodate large fixtures without sacrificing stroke length. The work-platen can be removed to permit machining special clearance holes.

An over-size, centrifugal pump driven by a separate motor supplies an adequate flow of coolant to the broach. Chips can be removed while the machine is in use without disturbing the operator. Controls can be furnished for stopping the machine at the top or bottom of the piston stroke, or an automatic return can be provided which functions after the piston has completed its downward travel. A specially designed hydraulic circuit is available which permits the use of shuttle type fixtures.

The "Senior" presses are available in seven sizes ranging from the 1-ton, 18-inch stroke size up to the 10-ton size with a 30- or 42-inch stroke. The 1-ton model occupies a floor space of only 18 1/2 by 30 1 2 inches, while the largest model requires a floor space of 29 by 51 inches. 54

Grob Improved Continuous-Motion Filing Machine

A heavy-duty, continuous-motion filing machine of improved design, known as Type FA-18, has just been brought out by Grob Brothers, Grafton, Wis. The machine shown in Fig. 1 has a throat depth of 18 inches, but the same model is also built with a 30- or 36-inch throat. It has a one-piece welded steel frame, with a 1/2-H.P. motor and silent V-belt drive built into the base. Three speeds—80, 120, and 160 feet per minute—are available for the files. The tilting, semi-steel table measures 20 by 20 inches.

The files are attached to a chain which is positively driven by a lower pulley having spring-cushion driving pins that impose very little tension on the chain. The flexibility of the file chain makes it possible to use two pulleys of small diameter in the upper arm as idlers. Thus, in spite of the large throat, the machine has a low over-all height and a relatively short file chain. Twenty files, each 5 inches long and of the types shown in Fig. 2, can be used on the 18-inch throat machine.

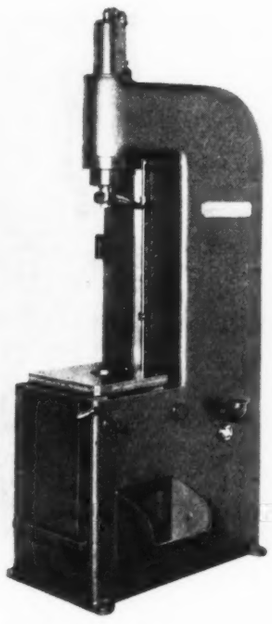
Channels mounted under the chain pulleys facilitate the insertion of the file chain. Tension is exerted on the file chain by a single lever movement. The machine occupies a floor space of 23 by 40 inches, and weighs 520 pounds.

Files also manufactured by Grob Brothers in a variety of styles and shapes, such as shown in Fig. 2, can be furnished with the machine. Standard files are furnished in single or double cut; fine, medium, coarse or shear cut; and in special types made to order. They are accurate in size within 0.001 to 0.002 inch in thickness and width, are securely guided through the working zone, and are positively driven. 55

Wagner Constant-Current Regulator

A constant-current regulator in the form of a compact unit assembly comprising the regulator and a controller-protector switch is a recent development of the Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. This regulator, known as Type Y-H, is said to have a supply current of unity power-factor when the load has a unity power-factor. Also, when the load has a lagging power-factor, the input current is said to have a leading power-factor of approximately the same numerical value.

The regulator has no moving coils, but operates from no load to full load, immediately adjusting its output voltage to varying load condi-



Colonial "Senior" Press Made in Seven Sizes with Capacities Ranging from 1 to 10 Tons

Fig. 1. Heavy-duty Continuous-motion Filing Machine Brought out by Grob Brothers

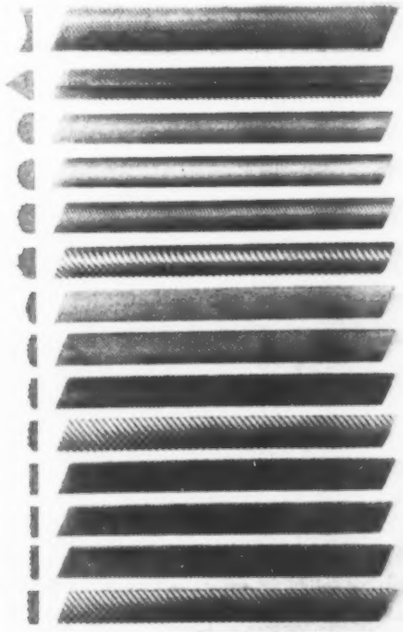


Fig. 2. Types of Files Made by Grob Brothers for Use on Machine Illustrated in Fig. 1

To obtain additional information on equipment described on this page, see lower part of page 158.

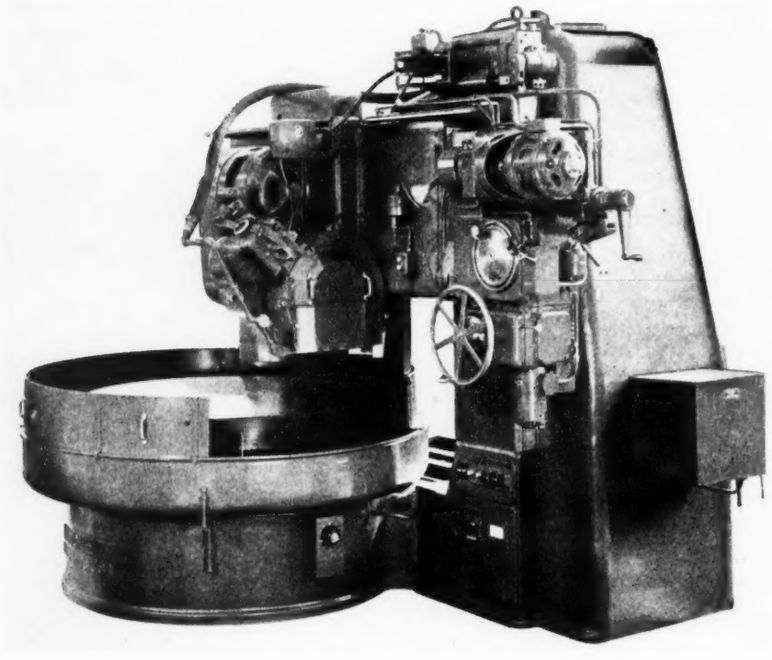
tions without surges on the line or lamp circuit, and is, consequently, adjusted instantaneously with changes in load. Owing to the extremely low current drawn, the supply line drop is very small. The regulator is suited for applications requiring constant current at all loads, including series street lighting systems, boundary and signal lighting for airports, flasher signs for advertising, etc. 56

Hanchett "Rotary Plano" Surface Grinder

The Hanchett Mfg. Co., Big Rapids, Mich., has recently developed a large surface grinder designated the "Rotary Plano." The grinding member, driven by a 30-H.P., 1200-R.P.M. motor, is mounted on a cross-rail between two columns. This counterbalanced rail has power elevation, provided by a 5-H.P. motor, and is automatically clamped to both the main and auxiliary columns.

The grinding wheel head has hand and automatic down feed and adjustable cross-feed, with a range of speeds of from 3 to 9 inches per minute, driven by a four-speed 3/4-H.P. motor. The ways on which the wheel-head travels can be tilted to an angle of 5 degrees in either direction. The machine can be fitted with a straight wheel on a horizontal spindle or a cylinder or segmental wheel on a vertical spindle. In any combination, the wheel-head can be hand or automatically fed in increments of from 0.0002 to 0.003 inch.

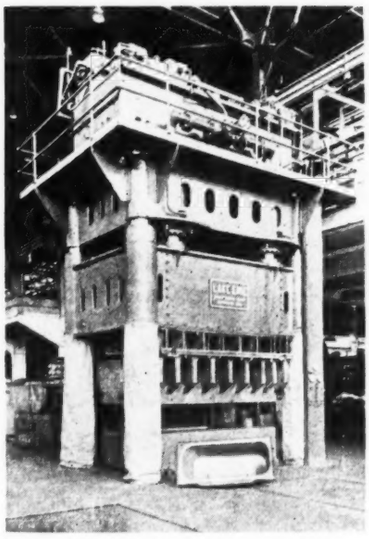
The 72- or 84-inch table is driven by a 15-H.P. motor through a variable-speed unit which gives a range of table speeds of from 6 to 18 R.P.M. Clearance is provided for swinging work up to 90 inches in diameter. The machine shown has a 24-inch wheel, a 72-inch magnetic chuck, and weighs approximately 75,000 pounds. 57



"Rotary Plano" Surface Grinding Machine Developed by the Hanchett Mfg. Co.

Lake Erie 1700-Ton, Double-Slide Press

A double-slide, hydraulic press having a capacity of 1700 tons has been built recently by the Lake Erie Engineering Corporation, Buffalo, N. Y. This huge press is believed to be the largest machine of its type ever built in this country. It is adapted for a wide range of drawing operations, the production of steel bath tubs like the one shown in front of the press in the illustration being typical of the work handled. A pressure of 900 tons is exerted on the blank-holder, and 800 tons on the main ram in cold-forming the 5-foot bath tub from 14-gage steel sheets, 65 by 79 inches in size. A high hold-down pressure prevents wrinkling the edges of the sheet when forming the tub without drawing beads.



Huge Double-slide Press Built by Lake Erie Engineering Corp.

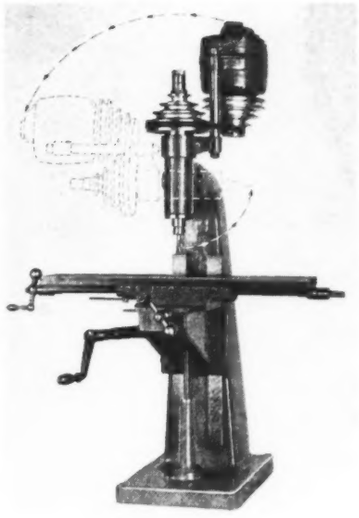
The press has a speed of several cycles per minute. The illustration shows the press as actually installed with the top of the bed located at floor level. The vertical columns are covered by flexible fabric boots that protect them against abrasive dust resulting from dressing the dies. The entire press is self-contained, with the pumping unit mounted on top. Operation is controlled by centrally located push-buttons. Adjustable pressure control is provided for the blank-holder and main ram. The press has a daylight opening of 98 inches, and a stroke of 37 inches. The bed is 160 by 106 inches. 58

"Univertical" Bench Milling Machine

A swivel-head type milling machine with graduations for tilting the head 90 degrees either side of the perpendicular position is being manufactured for, and placed on the market by, J. D. Duffy & Son, 544 Insurance Exchange Bldg., Detroit, Mich. This machine is designed for the most exacting precision work. It is compact and powerful, and will perform milling, drilling, boring, and contour-milling operations. An 8- by 16-inch die can be milled at one setting. The machine can also be adapted to small grinding operations.

It is driven by a 1/4-H.P. motor, and has a four-speed V-belt pulley

To obtain additional information on equipment described on this page, see lower part of page 158.



"Univertical" Swivel-head Type Milling Machine

which provides a range of from 850 to 3400 R.P.M. The maximum distance between the table and the end of the spindle is 10 inches, with a work clearance of 6 1/2 inches from the center of the spindle to the supporting column. The table is 24 by 4 7/8 inches, and has a cross-travel of 17 inches, with a forward and back travel of 7 inches. All table movements are controlled by handles having dials graduated to 0.001 inch. The spindle is equipped with a 1/2-inch Weldon tool-holder to accommodate tools from 1/4- to 5/8-inch in diameter. 59

Triple-Action, 650-Ton Hydraulic Press for Aircraft Manufacture

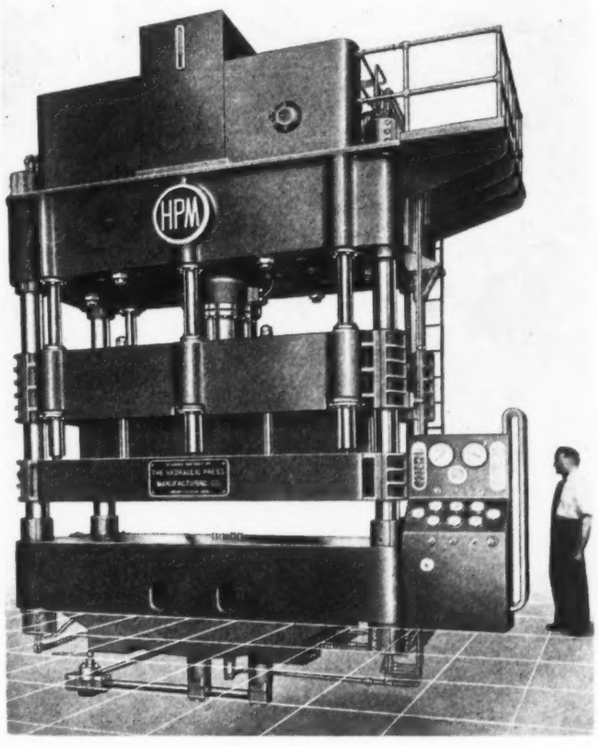
The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has recently developed a 650-ton, triple-action, hydraulic press of the blank-holder type, for deep drawing operations on gasoline tanks and similar parts for the aircraft industry. This press embodies three separate hydraulic actions for operating the main drawing punch, the blank-holder ring, and the die bottom of the regulation triple-action drawing die. The drawing punch is carried by the main slide, which is actuated by the main hydraulic press ram, of the double-acting piston type.

Some of the important features of this H-P-M Fastraverse press are: Accurate alignment of blank-holder die ring, which is rigidly supported by a platen directly above the ring; individual pressure adjustment of each blank-holder ram, permitting variation of pressure at six separate points; all three hydraulic actions operated by only one H-P-M Hydro-Power piston type radial pump directly connected by one flexible coupling to an electric motor; and closed circuit operating system that provides smooth action with valveless-shockless press reversal.

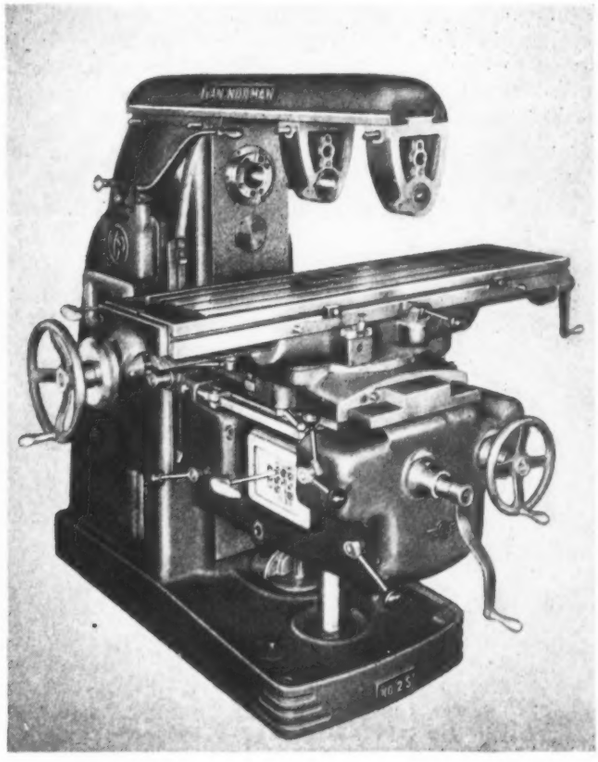
The tonnage capacities are: Main platen, 650 tons; blank-holder, 250 tons; and die cushion, 133 tons. The pressing surfaces are: Main platen, 144 by 72 inches; blank-holder, 144 by 72 inches; and die cushion, 59 by 35 inches. The closing speed is 260 inches per minute; the pressing speed, 45 inches per minute; and the opening speed, 260 inches per minute. A motor of 100 H.P., having a speed of 900 R.P.M., is required to operate the press. 60

Van Norman Horizontal Milling Machine

The Van Norman Machine Tool Co., Springfield, Mass., has brought out a new No. 2-S horizontal miller which is available both in plain and universal types. It has been designed and equipped to provide maxi-



H-P-M Fastraverse 650-ton Press Built for Deep Drawing Operations on Gasoline Tanks for Aircraft Industry



Milling Machine Available in Plain and Universal Types, Built by the Van Norman Machine Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 158.

mum metal-removing capacity. There are eighteen spindle speeds ranging from 25 to 1250 R.P.M., selected by a single lever. The eighteen feeds available also have single-lever directional controls both at the front and the rear of the machine. Power rapid traverse in all directions is provided for the 50-inch by 12-inch table. 61

Broaching Machine Equipped for Producing Bourrelet Grooves on 81-Millimeter Shells

The American Broach & Machine Co., Ann Arbor, Mich., recently built the broaching equipment here illustrated for a prominent manufacturer engaged in defense production work. The operation performed by this equipment consists of broaching the three bourrelet grooves in 81-millimeter shells made from free-machining steel. On each stroke, the broach cuts a groove about 0.025 inch deep by 1 1/8 inches long. The work is indexed into position for each of the three strokes required to finish the grooving operations. The operating cycle requires 45 seconds, and the production is 70 pieces per hour when operating at 85 per cent efficiency.

The machine illustrated is a standard V-2, 6-ton, vertical hydraulic press with a control latch for holding the ram in the lower position while the operator indexes or unloads the work. The tool equipment consists of the work-holder and broach-guide assembly, mounted on a common base, and a floating ram attachment. The illustration shows the fixture in the broaching position with the shell nose resting in a formed adapter. The boat tail is held in a chuck operated by the knurled handwheel directly above the shell. Clamping of the work in the bottom locator is accomplished by means of the main operating lever on the right-hand side of the fixture.

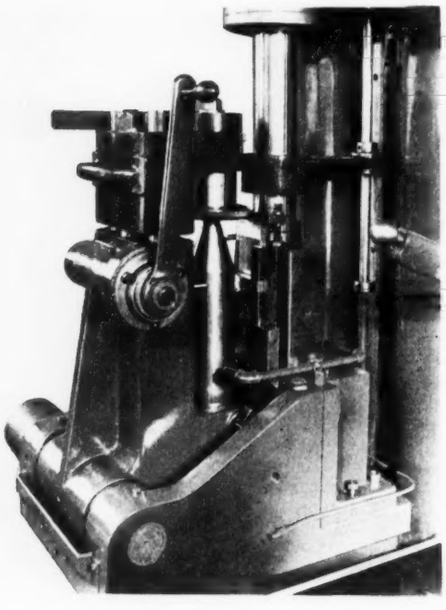
The fixture is manually tilted back to the loading or indexing position by rocking it on the large trunnion bearings shown in the lower left-hand corner of the fixture base. The shell is centered at both ends and supported by means of an automatic jack directly in back of the section broached. The work can be clamped in the bottom locator and indexed for the three broaching strokes without being unclamped. 62

Cleveland Vertical Tapping Machine with Automatic Reversing Mechanism

The Cleveland Tapping Machine Co., 1725 Superior Ave., Cleveland, Ohio, has just placed on the market an automatic tapping machine equipped with a clutch of special design that can be adjusted for tapping threads ranging in size from 6-32 up to 1/2 inch in steel. The special clutch, with finger-tip control, can be adjusted for this wide range of tap sizes while the machine is running. No pressure is required on the hand-lever when the tap enters the work, and the sensitivity of the clutch practically eliminates tap breakage.

When the tap is started, the machine makes a complete cycle, automatically tapping the hole, stopping, reversing, and backing out the tap, raising it to the top of its stroke, and reversing its rotation preparatory to tapping the next hole. The depth to which the hole is tapped is determined by simply setting the depth gage. With this arrangement, thirty holes can be tapped in one minute.

The table is 12 to 16 inches, has a large oil trough, and is easily adjusted for height by means of a rack and gear. It swings horizontally and has a vertical movement of 34 inches. The approximate tapping speeds generally employed are 260, 345, 560, and 870 R.P.M. These speeds can be varied as desired by changing the four-speed pulley on the motor. The machine is equipped with a 1 2-H.P. motor. 63



Broaching Machine Built by the American Broach & Machine Co.

Cleveland Automatic Reversing Tapping Machine

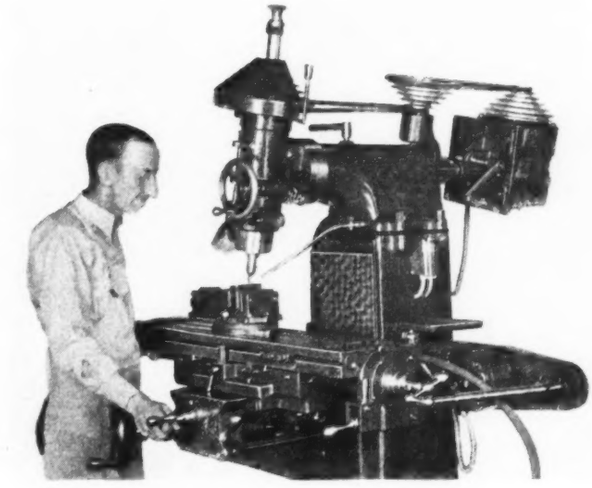
Improved "Millmaster" Milling Machines

Deluxe models of the "Millmaster" milling machines built by the Midway Machine Co., 2324 University Ave., St. Paul, Minn., now include a center or third pulley attachment and a table power-feed attachment as regular equipment. These attachments are available on standard models or can be purchased separately. The table power-feed unit provides longitudinal movement only. A 1 4-H.P., three-phase motor is utilized providing seven speeds with stop, start, and reverse.

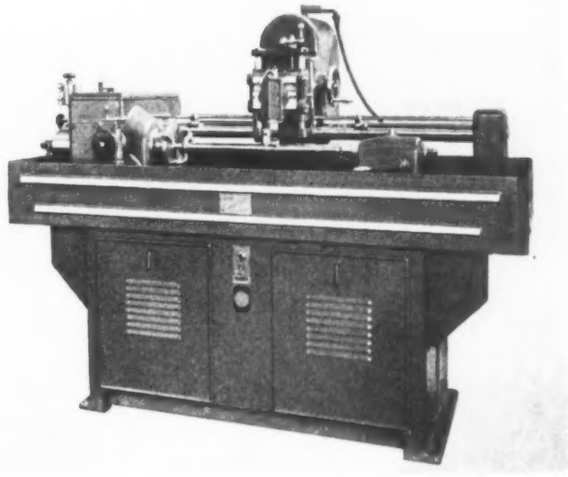
Both standard and deluxe Millmaster machines are now furnished with the following equipment: Motor-driven pump and storage tank for coolants or cutting compounds, which can be installed in the base of the machine for furnishing a constant supply of compound directly to the work; and a gravity drain that returns the coolant to the tank, eliminating all waste. A 1/4-H.P. motor and pump are furnished.

An indexing headstock and tailstock are now available for all models. A vernier attachment for high precision work can be furnished at

To obtain additional information on equipment described on this page, see lower part of page 158.



Deluxe "Millmaster" Equipped with Table Power-feed Attachment



Superfinisher of Increased Capacity Brought out by the Foster Machine Co.

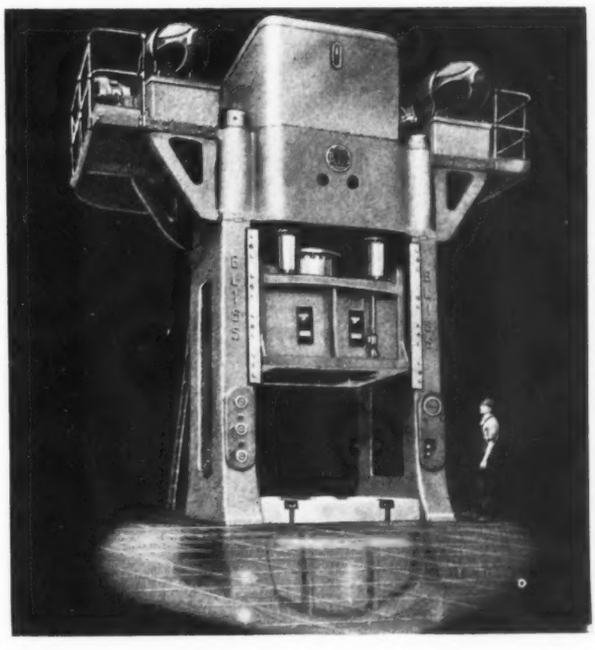
additional cost. This equipment consists of a vernier scale and plate reading to 0.001 inch. The length of the Millmaster table has been increased from 26 to 38 inches, and the weight of the complete machine has been increased from 1600 to 1800 pounds. 64

Bliss 800-200 Ton "Hydro-Dynamic" Press

An 800-200 ton "Hydro-Dynamic" press has just been brought out by the Hydraulic Division of the E. W. Bliss Co., 53rd St. and 2nd Ave., Brooklyn, N. Y. This press is of the double-action type, with universal electric control, and is equipped with an auxiliary hydraulic pressure cushion in the bed. High-speed operation is furnished by two 125-H.P. motors. The push-button control is so arranged that the inner main slide cannot come in contact with the work until after the desired blank-holder pressure is applied by the outer slide.

The main drive brings the two slides to the work simultaneously, the inner slide halting for a fraction of a second while the blank-holder pressure is applied. The drive immediately proceeds at the drawing speed, following the slight dwell of the inner slide. Reversal may be controlled either by the slide position or by pressure in the hydraulic system. Positive inching for die-setting is controlled by means of a push-button.

The principal specifications are as follows: Capacity of main slide, 800 tons; capacity of blank-holder slide, 200 tons; capacity of cushion in bed, 150 tons; bed area, front to back and right to left, 84 by 85 inches; distance from top of bed to face of blank-holder slide, with the slide up 95 inches, and with the slide down 69 inches; maximum stroke of main slide, 42 inches. 65



Double-action 800-200 Ton "Hydro-Dynamic" Press Built by the E. W. Bliss Co.

Foster Superfinisher of Increased Capacity

The Foster Machine Co., 902 Foster Bldg., Elkhart, Ind., has just brought out a 4- by 36-inch superfinisher designed to handle larger work than can be accommodated on the general-purpose 4- by 18-inch machine previously placed on the market. The new machine is especially adapted for superfinishing large size guide bars for die sets, piloted boring-bars, and almost any cylindrical work up to 4 inches in diameter and 36 inches in length. It can also be built to accommodate work approximately 50 inches between centers.

Like the Foster general-purpose superfinisher, the new machine is designed for collet, chuck, or center work, and can be provided with centerless or flat surface attachments. Thus, the machine is practically universal in application, and can be used to advantage by both small and large manufacturers.

The outstanding features include a mechanical drive to the traverse, which also has a hand adjustment for positioning. The spindle is driven by a Graham transmission with a stepless adjustment of speeds ranging from 0 to 500 R.P.M. This machine has a quick stone-retraction device, and

To obtain additional information on equipment described on this page, see lower part of page 158.

standard single and double stone-holders are available. The bars carrying the superfinishing head are parallel and positioned horizontally. This arrangement reduces the overall height of the machine. A positive stop can be used to position the head accurately in relation to the surface being finished. 66

High-Speed Head with Hydraulic Duplicating Attachment

The Duplicating Attachment Co., 852 Clairpointe Ave., Detroit, Mich., has brought out a No. 3C high-speed head with a hydraulic duplicating attachment. This equipment is designed to handle the average range of work in small, as well as large, die shops and engraving shops engaged in making plastic, rubber, Bakelite, and drop-forging dies.

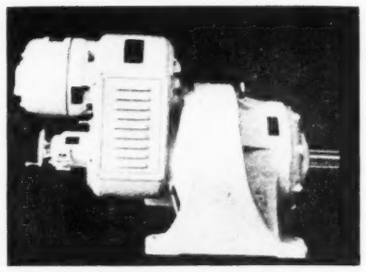
The plastic or wooden model is placed below the tracer, and the die is placed below the cutter. By feeding the table of the milling machine back and forth, the tracer automatically controls the vertical travel of the cutter, which produces an exact duplicate of the model. A pressure of less than 1 pound is exerted on the tracer, while the cutter is subjected to a pressure of about 500 pounds.

There is a distance of 17 3/4 inches between the cutter and the tracer, and the vertical travel of the spindle is 4 inches. The spindle will take a No. 9 B&S taper-shank holder for end-mills of the draw-bar type. The spindle is driven by a 1/2-H.P., 1125-R.P.M. motor, and there are four speeds ranging from 225 to 3400 R.P.M. 67

"Reciproc" Drill-Press Attachment for Sanding, Grinding, and Lapping

An oscillating mechanism that can be mounted on a standard type drill press for imparting a reciprocating motion to the spindle, has been developed by the Specialty Machinery Co., Box 1175, Station B, Cleveland, Ohio, for use in performing sanding, grinding, and lapping operations. This mechanism will impart a longitudinal oscillating motion to a sanding drum held on the machine spindle, as shown in the illustration. With a standard 1740-R.P.M. motor, the mechanism provides the drill-press spindle with 100 complete strokes or 200 working strokes per minute. This reciprocating movement is instantly adjustable to any length between 1/4 and 7/8 inch.

When mounted on a drill press, this mechanism converts the machine into a die grinder for straight work, using a guiding fence, as well as for irregular free-hand grinding or templet grinding work. It can also be used for lapping operations when producing close-fitting holes. 68

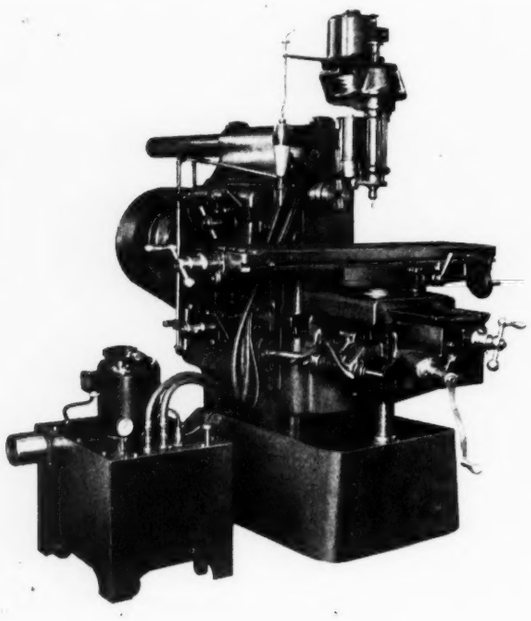


"Varidrive-Syncrogear" Unit Made by U. S. Electrical Motors, Inc.

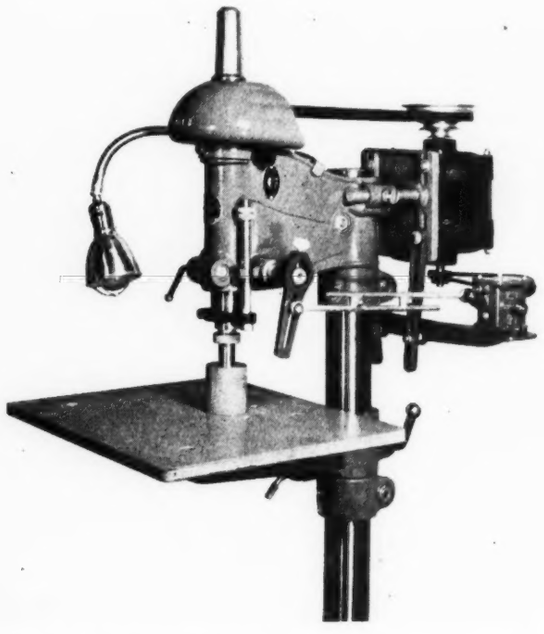
Compact "Varidrive-Syncrogear" Units

In order to provide more compact and smaller driving units, the U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles, Calif., and 80 Thirty-fourth St., Brooklyn, N. Y., has added the Types VEV-GD and VEV-GT to its "Varidrive" line. These motors are of the Varidrive speed design with the double- and triple-reduction gears adapted for low-speed drives. No sub-base is required to mount the Varidrive and Syncrogear as a unit in this new arrangement, which is, consequently, much lighter than previous units.

The design of the new Varidrive case permits it to be mounted at any angle with respect to the gear-case. If the unit is to be mounted where head-room is low, the Varidrive case can be placed on its side or at any convenient angle. 69



Milling Machine Equipped with High-Speed Head and Hydraulic Duplicating Attachment



Drilling Machine Equipped with "Reciproc" Attachment and Sanding Wheel

To obtain additional information on equipment described on this page, see lower part of page 158.

New "Giant Kippcaster"

The Madison-Kipp Corporation, 203 Waubesa St., Madison, Wis., has just brought out a die-casting machine for zinc alloy known as the "Giant Kippcaster" Model No. 500. This new die-casting machine is about twice as large as the standard Kippcaster which this company has built for many years. The weight of the new Kippcaster, however, is more than four times that of the previous standard machine. The new machine has the added strength needed for handling larger parts than can be cast in the standard Kippcaster.

Operation of the Giant Kippcaster is accomplished by a combination of hydraulic and air equipment, whereas the previous standard machine was entirely air-operated. The die-head ram of the new machine is operated hydraulically through a special toggle arrangement which is actuated by a hydraulic cylinder. A Vickers combination pump with a 1 1/2-H.P., 1200 R.P.M. motor comprises the standard hydraulic system. The standard die-head is 8 by 10 inches, but clearance is provided so that larger dies can be applied. Both the stationary and the movable dies may be of two standard thicknesses, namely, 3 and 4 inches.

The stroke of the machine is 8 1/2 inches; and when a standard air cylinder of 7 1/2 inches is provided with a standard metal plunger of 1 3/4 inches, a pressure of 1836 pounds is exerted on the metal, with an air pressure of 100 pounds. The gooseneck, with standard plunger, has a capacity for "shooting" a 3 1/2-pound casting in zinc alloy, and the pot will hold 200 pounds of zinc. The length of the machine is 8 feet 1 inch; the width, 3 feet 8 inches; the height, 6 feet 2 inches; and the weight, 6500 pounds. 70

Hardinge High-Speed Precision Lathe

The high-speed precision lathe recently brought out by Hardinge Brothers, Inc., Elmira, N. Y., has incorporated in its design the refinements of similar machines previously built by this company and formerly designated bench lathes. This new machine has been developed for use in large batteries in tool-rooms and production departments, as well as in experimental and laboratory departments, where only one or a few machines are required.

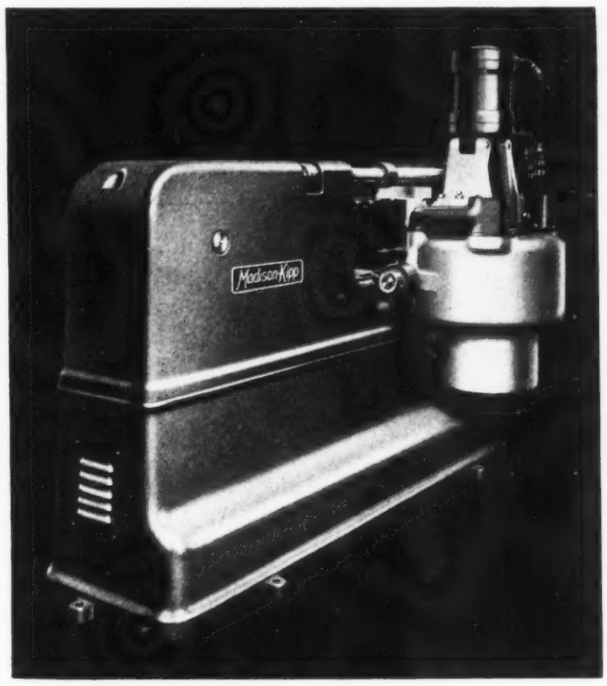
This lathe has an enclosed head with preloaded ball-bearing spindle. A driving unit with multi-speed motor is used, in which no gears, clutches, or loose pulleys are employed. A wheel is furnished for turning the spindle by hand when setting up, making tests, or when finishing a thread by hand.

The compound slide rest has large beveled dials, designed for easy reading. The two levers at the headstock end control the low, stop, high, forward, brake stop, and reverse spindle speeds through the operation of electrical motor controls. A chart at the front of the machine shows the speeds obtainable. There are eight forward and eight reverse speeds ranging from 230 to 3900 R.P.M.

The welded steel pedestal completely encloses the motor and driving unit. The motor and drive are mounted at the bottom of the pedestal, with the motor completely insulated by rubber cushions. The motor belt can be easily changed from one step of the motor pulley to the other by opening a door at the front of the pedestal. This lathe is available in five sizes, the largest size having a collet capacity of 1 inch and a swing of 9 inches. 71

Micro Switch with Roller Plunger Actuator

The compact, die-cast, Micro Switch made by the Micro Switch Corporation, Freeport, Ill., is now available with a roller type plunger and a sturdy, castellated brass bushing which receives the roller either longitudinally or crosswise. This switch is available with a zinc or aluminum die-cast housing. 72



Hydraulically and Pneumatically Operated "Giant Kippcaster"

Hardinge High-Speed Precision Lathe Built in Five Sizes

To obtain additional information on equipment described on this page, see lower part of page 158.

Geometric Chaser Grinder

The Geometric Tool Co., New Haven, Conn., has brought out a No. 20 chaser grinder that is designed for the single purpose of sharpening chasers, both on the chamfer and on the cutting face. The work-table has a longitudinal travel of 8 inches and a transverse travel of 3 3/4 inches. The working surface of the table is 4 by 19 inches, and has a 9/16-inch T-slot. Each graduation on the micrometer feed dial and on the cross-feed handwheel indicates a movement of 0.001 inch.

The wheel-head can be adjusted to give a maximum distance from the center of the spindle to the top of the table of 13 1/4 inches and a minimum distance of 2 1/2 inches. Combination rapid and micrometer feed of the wheel-head is available, each graduation on the micrometer dial representing 0.0005 inch. For chamfering operations, a 9- by 3/4- by 1 1/4-inch dish wheel is used, and for face grinding with a magnetic chuck, a wheel of the same diameter, but with a 1/2-inch face, is employed.

For rechamfering conventional milled or tapped die-head chasers or collapsing tap chasers, it is recommended that the Style E Geometric universal grinding fixture shown mounted on the machine table in the accompanying illustration be used. A Style A chamfer grinding fixture can also be used with this machine, but it is recommended only for use with milled chasers. While conventional chasers of the milled or tapped type or collapsing tap chasers can be resharpened one at a time on the cutting face by employing the Style E grinding fixture, it is recommended that a complete set be resharpened at one set-up. An inexpensive magnetic chuck of the tilting type is available for this purpose.

The motor is a 1/3-H.P. single or polyphase type with V-belt drive. The machine occupies a floor space 44 by 32 inches, and weighs, complete with motor, 560 pounds. 73

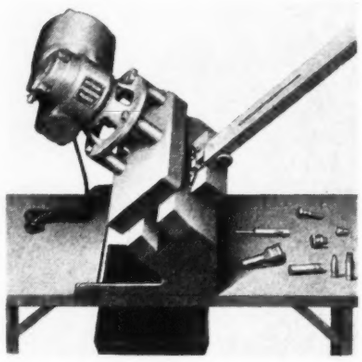
Chaser Grinder Brought out by the Geometric Tool Co.

Langelier Sensitive Drill

The Langelier Mfg. Co., Providence, R. I., has recently brought out a No. 41 ball-bearing drill of the precision type. Extra large sealed type bearings that require no additional lubrication are used on the sleeve that carries the driving pulley. Similar bearings are also used on the spindle end to take the drill thrust. This spindle mounting eliminates belt pull and insures a very sensitive feed.

Sensitive Drill Brought out by the Langelier Mfg. Co.

The feed-lever can be adjusted to several different positions, and the operating rack and pinion is protected by a guard. In drilling to a fixed depth, a course setting is first made, using a stop-rod. The final micrometer adjustment is obtained with a depth stop-screw which has a fine thread adjustment. The motor bracket can be adjusted to give the proper belt tension. The table and base have rims for retaining oil and chips. A ball-bearing motor and a 1/4-inch chuck are supplied as regular equipment. This drill is obtainable in bench, pedestal, and gang models. 74



Hoffmann High-speed Marking Machine

High-Speed Marking Machine for Metal Products

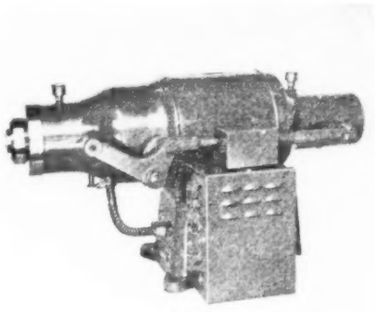
A machine marketed under the name Hoffmann "Production Marker," which is designed for the high-speed production marking of light or heavy formed metal parts by "rolling in" the identifying trade names, trademarks, orifice sizes, part numbers, or other identification markings, is being manufactured by the Quality Die Co., 9313 Baltimore Ave., South Chicago, Ill. A production speed as high as 7000 pieces an hour without jamming is said to be possible with the especially designed rotary mechanism when employed for marking such products as shells; carbureter jets; ventura tubes; spark-plug bodies; round, tubular, or solid parts; or round pieces with hexagonal or octagonal flanges or shoulders.

The machine is driven by a geared motor. The driving mechanism is fully enclosed, and grease-sealed bearings are used throughout. The enclosed gears are greased by means of Alemite fittings. The marking die is specially made, and can have any number of lines. It also embodies insert types to permit changing numbers or insignia. Actual operation of the marking machine is automatic, only simple hand-feeding of parts to the gravity feed chute being required. 75

Schauer High-Production Speed Lathe

Light finishing operations, such as burnishing, lapping, burring, or polishing of small parts, can be performed rapidly and economically on a new high-production speed lathe brought out by the Schauer Machine Co., 2060 Reading Road, Cincinnati.

To obtain additional information on equipment described on this page, see lower part of page 158.



Schauer High-production Speed Lathe

Ohio. Continuous motor operation is a feature of the new machine. The collet and spindle are magnetically controlled, and are engaged or disengaged by operating a foot-treadle.

This machine is adapted for the final finishing operations on ball-bearing races, headless set screws, gears, pinions, pulleys, spinning rings, screw machine products, wire drawing dies, etc. Special built-in features are available for handling rods, tubes, and chuck stock. 76

Chip-Breaker Grinder and Universal Ball-Joint Vise

The Strickland precision chip-breaker grinder shown in Fig. 1 and the Strickland universal ball-joint vise shown in Fig. 2 have been brought out by Engineering Service, Inc., 6308 Pacific Blvd., Huntington Park, Calif., especially for use in grinding chip-breakers in carbide cutting tools with diamond wheels. The grinder has both vertical and traverse adjustments, which are controlled by graduated handwheels. These features, in combination with the universal quick-setting ball-joint vise, enable the operator to grind chip-breakers to the exact dimensions and form desired for any particular purpose.

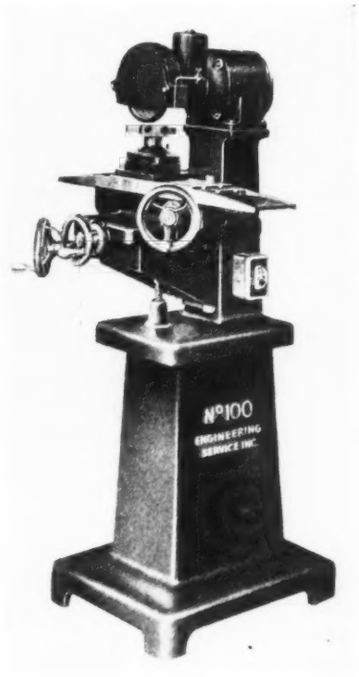


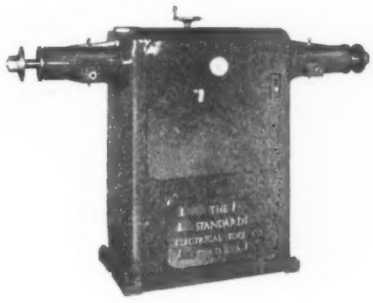
Fig. 1. Strickland Chip-breaker Grinder with Ball-joint Vise

The reciprocating longitudinal movement required for grinding the cutting tool by means of a diamond wheel is controlled by the rocking motion of a handwheel. The machine is provided with a water reservoir, and there is a valve for controlling the flow of water to the wheel. A 1 2-H.P. motor drives the ball-bearing wheel-spindle at a speed of 3450 R.P.M., which gives the correct surface speed for a 6-inch diamond wheel.

Fig. 2. Strickland Ball-joint Vise Designed for Quick Adjustment to Any Angle

The table has a longitudinal travel of 12 inches, a transverse travel of 6 inches, and a vertical movement of 5 1/2 inches. The working surface of the table is 5 by 12 inches. The machine weighs 450 pounds.

The ball-joint vise has a height of 5 1/4 inches and a 30-degree arc adjustment through the horizontal plane. It permits the work to be located in any horizontal angular position; any vertical angular position combined with any horizontal angular position; and in any compound vertical angular position combined with any horizontal angular position. It is especially recommended for use in grinding chip-breakers, curlers, and rake angles on carbide tools and cutting tools of other materials. 77



Buffing and Polishing Machine Made by the Standard Electrical Tool Co.

Variable-Speed Buffing and Polishing Machine

The Standard Electrical Tool Co., 1948 W. Eighth St., Cincinnati, Ohio, recently developed an infinitely-variable-speed buffing and polishing machine designed to meet all requirements for buffing, polishing, coloring, etc. The correct speed for each operation can be obtained with any size or type of wheel. This feature provides for longer wheel life and more efficient production, with an additional saving due to the fact that the worn wheels can be used efficiently by increasing the spindle speed to maintain the proper peripheral speed.

The change in speed is accomplished quickly by merely turning a handwheel. Each change of spindle speed is shown in revolutions per minute on the indicator at the front of the machine. Although the full speed range is from 1000 to 3500 R.P.M., the speed-changer can be set for any intermediate speed range desired.

All the equipment, including the speed-changer, constant-speed, 1800-R.P.M., ball-bearing motor, and magnetic starter, is enclosed inside the base, while the push-button station is located at the front of the machine. Removable louvered covers at the sides and front, and a large removable cover at the top, provide easy access to the mechanism inside the base. A shaft lock is provided for use when changing wheels. The machine is available in 3-, 5-, and 7 1 2-H.P. sizes, while larger sizes can be furnished to order. 78

Carrying Case for Dumore Hand Grinders

To keep Dumore hand grinders free from dust and dirt in the shop and to prevent them from being mis-

To obtain additional information on equipment described on this page, see lower part of page 158.

placed, the Dumore Co., Racine, Wis., is now making a sturdy steel carrying case for the No. 8 and the No. 10 hand grinders built by the company, the size of the case being 11 by 4 1/4 by 3 1/4 inches. The case also has a compartment for storing grinding wheels, abrasive bands, and arbors. 79

Federal Flash-Welding Machine

The Federal Machine & Welder Co., Warren, Ohio, has recently brought out a new flash-welder which combines modernistic design with features developed to insure efficient operation on production work. This welder, known as the Federal Type F-4, is of side-bar construction which provides the advantages of a long slide for the moving platen of the machine. The slide is carried in sealed bearings provided with continuous lubrication. The enclosed design eliminates the possibility of flash getting into the bearings and scoring the moving parts.

Various types of clamping fixtures designed to accommodate the many varieties of welding jobs which may be handled on this type of equipment can be bolted on the flat-top platen of the machine. The flash chute, located under the welding position, is easy to clean, and at the same time, prevents the flash from getting down into the transformer in the base.

The entire drive arrangement, which is mounted on the moving platen end of the machine, is enclosed, and yet is easily accessible by removing the covers. The mechanism is motor-operated through a variable-speed drive.

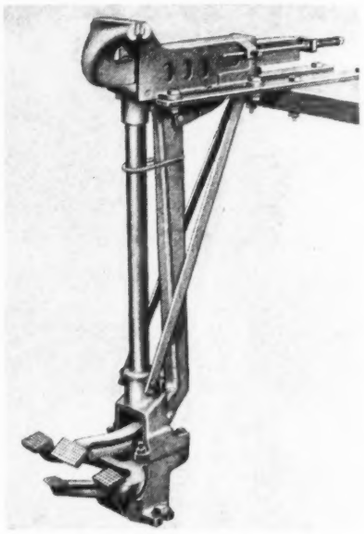
This machine is made in transformer capacities up to 150 K.V.A. It is suitable for welding stock up to 1 square inch of welding area, and can be used for rounds, flats, or formed sections. 80

Automatic Vise

A pedal-operated automatic vise that enables work to be clamped quickly between its jaw with the desired pressure and that leaves the operator's hands free, has been brought out by the Automatic Vise Sales Co., 2845 Sunset Place, Los Angeles, Calif. The movable jaw of the vise slides freely and is easily pushed with the hand or body against the work to be clamped. This, as well as the clamping and releasing, is an instantaneous operation. Both releasing and clamping are accomplished through foot-pedals.

The main clamping pedal gives sufficient pressure for general work, but if additional pressure is desired, the small auxiliary pedal immediately below the main pedal can be operated. The two side pedals are both used for releasing the work. By simply adjusting a small screw on the right side of the body, the vise is set for repetitive work and operates automatically.

This vise can be mounted directly on the bench or away from the bench, as shown in the illustration, by using 3/8- by 1 1/4- by 18-inch strips of steel, one on each side, as an anchorage to the bench. The latter installation gives more working space on each side of the tool, without interference with the bench. A portable stand (not shown) is also available. 81

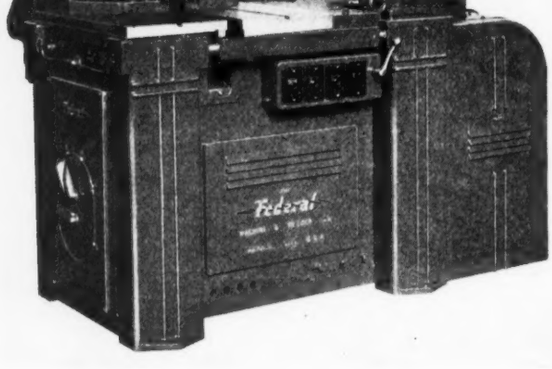


Foot-operated Automatic Vise

Hisey-Wolf Direct-Drive Disk Grinders

Extra heavy end bells with feet which carry the bearings directly behind the grinding disks constitute one of the improved features of the new direct-drive disk grinders built by the Hisey-Wolf Machine Co., 2800 Colerain Ave., Cincinnati, Ohio. The method of lubricating the bearings, as well as their construction, has also been improved. The oilers employed are of the constant-level type.

The motor is totally enclosed, and is cooled by the circulation of air which passes through the feet of the



Flash-welding Machine Developed by Federal Machine & Welder Co. for Production Work

Hisey-Wolf Direct-drive Disk Grinder with Improved Motor-cooling System

To obtain additional information on equipment described on this page, see lower part of page 158.

end bells into the pedestal and back through the motor. This arrangement gives the advantages of a totally enclosed motor, with air-cooled operation. The grinder is made in 3- to 10-H.P. sizes. Guards can be supplied with exhaust connections, and combination machines can also be furnished with a disk on one end and a regular grinding wheel or buffing extension on the other. 82

Acme "Hot Spot" Welders

As companion lines to the Types 0 and 1 foot-operated "Hot Spot" welders recently brought out in 10-, 15-, and 20-K.V.A. capacities by the Acme Electric Welder Co., 5621 Pacific Blvd., Huntington Park, Calif., this company is now placing on the market foot-operated, rocker-arm Type 2 welders in 20- and 30-K.V.A. transformer capacities, and Type 3 welders in 40- and 50-K.V.A. transformer capacities.

The streamline housings of these spot-welders are of all-welded, fabricated steel construction. The horns are of the double-end, reversible type, one end being machined to hold electrodes at an angle of 90 degrees, and the opposite end at an angle of 22 1/2 degrees. The arrangement of the swivel lower horn-holder on a long column allows for horizontal and vertical movement of the lower horn to facilitate welding in places that are hard to get at, as well as the welding of deep pans or boxes.

Special features include clamping-block devices which retain the horns in their holders with perfect electrical contact, yet permit them to be instantly released for making changes in the set-up. 83

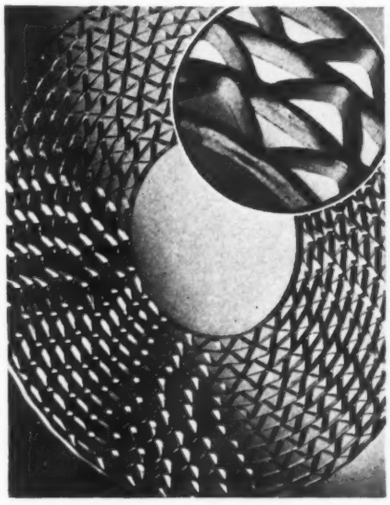


Fig. 1. FerroFilter Screen, with Magnified Inset of Screen Edges on which Magnetic Particles are Collected

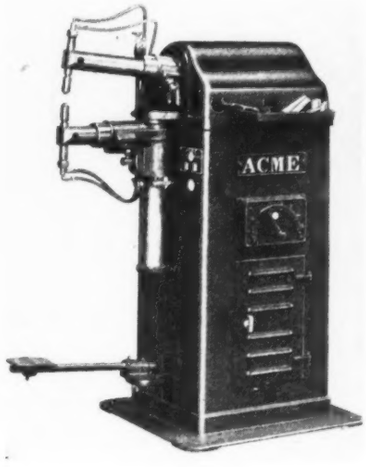
Fig. 2. Pipe Line Type of FerroFilter which can be Used in Vacuum or Pressure Lubricating-oil Lines

Frantz FerroFilter for Removing Iron and Steel Particles from Lubricants

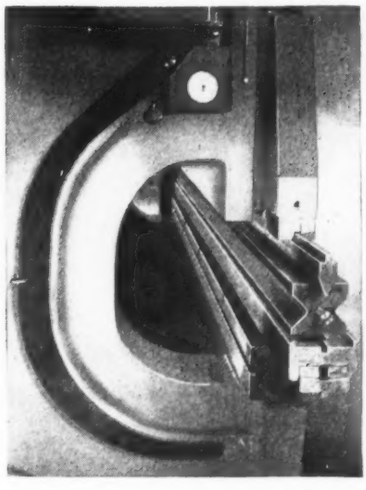
The S. G. Frantz Co., Inc., 161 Grand St., New York City, has placed on the market a filter that can be installed in vacuum or pressure pipe lines handling coolants or lubricating oils for magnetically removing iron and steel particles. It is claimed that this filter will remove particles as fine as 1/25,000 inch from suspension in liquids at the cost of only a few cents per thousand gallons. It is applicable to machine tool cutting oil systems and to the lubricating systems of Diesel engines, aircraft engine test and run-in stands, reduction gears, etc.

The liquid material to be cleaned is passed through a stack of magnetized screens, such as shown in Fig. 1. These screens are enclosed in a cylindrical casing, as shown in Fig. 2. The screens, although offering comparatively little resistance to the flow of the liquid, present up to 8000 feet of strongly magnetized edges which catch and hold the particles of iron until the machine is shut down. The filter is then demagnetized and flushed.

The model shown in Fig. 2 is operated by direct current at 110 to 120 volts, but portable tube type rectifiers are available which will supply the required current from a sixty-cycle, alternating-current lamp socket. The filter is made in four capacities, the smallest handling 20 gallons of lubricating oil per minute, and the largest size 200 gallons per minute. 84



Foot-operated Acme "Hot Spot" Welder Made in Several Capacities



Tonnage Indicator Developed for Use on "Steelweld" Bending Presses

Tonnage Indicator for "Steelweld" Bending Presses

A tonnage indicator for "Steelweld" presses which keeps both the operator and the management informed of the loadings to which the press is subjected, has been developed by the Steelweld Machinery Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. This indicator serves to warn the operator when the dies have become worn excessively, and records excess stresses caused by "over-bottoming."

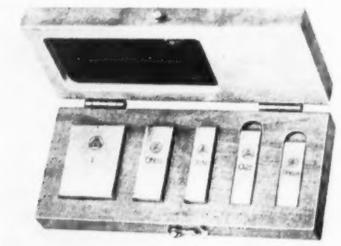
The indicator has two pointers—the "job" pointer which registers the tonnage for the individual job being handled, and the "maximum load" pointer which indicates the maxi-

To obtain additional information on equipment described on this page, see lower part of page 158.

mum load at which the press has ever been operated. The job pointer remains at the highest tonnage reading developed. It may be reset to zero reading at any time. Once set, the indicator requires no further adjustment, and can be locked to prevent tampering. 85

"Mechanic's Own" Precision Gage-Blocks

The George Scherr Co., 128 Lafayette St., New York City, has recently added a set of gage-blocks designated the "Mechanic's Own" to its line of Ultra-Chex precision length standards. This set of stand-



Toolmaker's Gage-blocks Brought out by the George Scherr Co.

ards is designed as a unit for the toolmaker's and mechanic's tool-box. The set consists of five gage-blocks which are accurate to eight-millionths of an inch in the following dimensions: 1, 0.500, 0.250, 0.125 and 0.0625 inch. 86

Leeds & Northrup Furnace Pressure Controller

Flexibility of installation, convenience of operation, and ease of adjustment are outstanding features of the completely redesigned industrial furnace pressure controller just placed on the market by the Leeds & Northrup Co., 4921 Stenton Ave., Philadelphia, Pa. The mechanism of this new controller is housed in a rigid die-cast case. Although designed primarily for flush mounting, it can be supplied for surface mounting. The controller and related equipment can be panel-mounted at the factory, and shipped completely connected and wired.

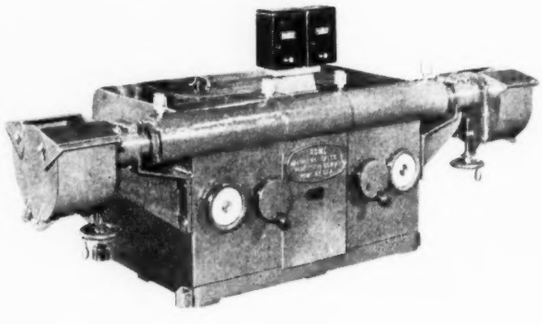
Pressure Controller for Furnace Made by Leeds & Northrup Co.

Built into the controller door is a selector switch and a push-button station. These space-saving accessories enable the operator to employ manual control at a moment's notice. Adjustments are facilitated by two sets of convenient weights. One set adjusts the zero setting of the simple mechanical balance of the instrument, while the second set adjusts its sensitivity. 87

Rome Polishing, Buffing, or Grinding Lathe

A wheel-spindle speed range of from 1800 to 7000 R.P.M. is available on the Model 2AS variable-speed lathe recently placed on the market by the Rome Machinery Sales & Engineering Co., 627-35 Webster St., Rome, N. Y. The wheel-spindles are each driven independently by a 3-H.P. motor. The speed adjusting handwheels, conveniently operated from each wheel position, have automatic speed indicating dials. The 24-inch height from the floor to the center of the wheel-spindle makes it possible for the operators to work on the tops of the wheels. This machine is adapted to the hand-processing, by grinding, polishing, or buffing, of a wide variety of hardware and miscellaneous small tools.

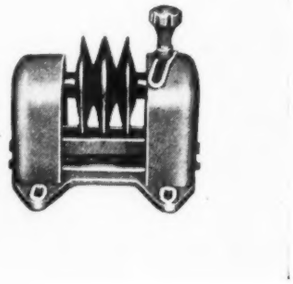
To insure safe operation, all driven mechanisms are effectively enclosed and are accessible for servicing through a door at the top of the motor compartment. The machine weighs 2400 pounds. 88



Rome Polishing and Buffing Lathe

"All-Speed" Variable-Speed Transmission

A new V-belt variable-speed transmission, known as the "All-Speed," has been brought out by the Standard Transmission Equipment Co., Suite 330, 416 W. Eighth St., Los Angeles, Calif. The speed selector

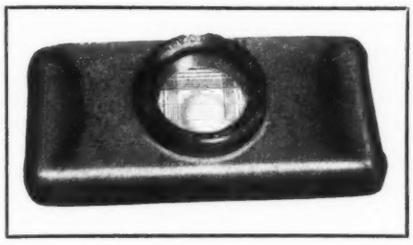


"All-Speed" Variable-speed Transmission

operates on the variable pulley principle and consists of two interlocking pulleys mounted on a common shaft. The variable-speed spindle can be pivoted laterally between the motor and the driven machine to provide new running diameters on the interlocking pulleys.

The selected speed is maintained by means of a lock-nut on the control quadrant, and the oblique slot which automatically and positively guides the spindle at all times insures accurate belt alignment and increases the belt life. This is a distinctive feature of the transmission which is especially advantageous when the control unit is mounted vertically as is often done in applications such as drill-press mountings, etc. Special impregnated bronze bearings are used with force-feed lubrication. This transmission is now being made in three sizes for 3/8-inch "A" and "B" type belts, and in speed-range ratios from 4 to 1 up to 12 to 1. 89

To obtain additional information on equipment described on this page, see lower part of page 158.



Fell Precision Level

All-Way Precision Level

A precision all-way level for use in machine tool building, setting up, and maintenance, for the establishment of level working surfaces, and for the accurate checking of straightness has been placed on the market by the Wm. B. Fell Co., 700 South St., Rockford, Ill. This level is made to indicate levelness in all ways or directions at once. Slopes are easily read to 0.00025 inch per foot. The graduations are in 0.0005 inch per foot and form squares about a circular bubble, thus giving coordinate readings and showing the direction and amount of slope, if any. 90

V-Belt Made to Prevent Accumulation of Static Electricity Charges

What is believed to be the first V-belt ever manufactured to prevent accumulation of static and to retain its static-discharging qualities during its service life has been developed by the B. F. Goodrich Co., Akron, Ohio. For the present, this belt will be sold only to machine or equipment makers. Its development is of especial interest to manufacturers of washing machines and other machinery where static discharges might create a fire hazard. 91

Hydraulic Booster Pump for Developing High Test Pressures

A new motor-driven hydraulic pump capable of developing pressures up to 6000 pounds per square inch is being placed on the market by the American Instrument Co., 8010-8020 Georgia Ave., Silver Spring, Md. This pump is especially adapted for use in creating high test pressures for determining the bursting strengths of cylinders, spheres, etc.; for operating high-pressure and hydraulic intensifiers; and for determining the effect of high pressures and their sudden release on various materials. It consists essentially of a geared-head motor for operation on 115- or 230-volt alternating or direct current, and a reservoir and compression chamber mounted on a cast-iron base. 92

G-E Alternating-Current Arc Welder with High Power-Factor

The General Electric Co., Schenectady, N. Y., has announced a new line of 500-ampere alternating-current arc welders incorporating mechanical improvements and a new electrical design with power-factor correction. It is claimed that this new feature practically eliminates useless lagging current, and, hence, permits the use of smaller primary cable, line switches, and fuses. A saving on installation costs and the opportunity to add more welders to existing feeders without causing overload are advantages claimed.

Other advantages include fingertip adjustment by means of an easily turned current-changing crank, a large current indicator, protected output terminals accessible through holes in the insulating panel, and fan-forced ventilation which provides cool operation even at high currents or high-duty cycles. This new welder is less than 4 feet in height, only 21 inches in diameter, and has a weight of 600 pounds. ... 93

G-E Arc Welder with High Power-factor

Tap and Reamer Aligner

A simple tool for aligning hand taps and reamers has been designed and is being manufactured by the Forest City Bit & Tool Co., Rockford, Ill. The tap-holder is made from tool steel, and the jaws are made of a specially processed tool steel. After a hole is drilled to tap size, the tool is set over the hole, as shown in the illustration, no time being lost in setting it square for accurate alignment. This aligner is made in three sizes, covering a range from 1/16 to 5/16 inch. 94

Device for Aligning Taps and Reamers Made by the Forest City Bit & Tool Co.

* * *

High-Impact Welding Compound

An addition to the new 1900 Black series of phenolic molding compounds, to be known as Durez 1905 Black, has been announced by Durez Plastics & Chemicals, Inc., of North Tonawanda, N. Y. This material has an impact strength of 0.6 (A S T M) and a heat resistance of 418 degrees F. Unusually good gloss for high-impact compounds is reported with this material. It is available only in the new particle size which is especially designed for free flowing through feeders and hoppers to simplify the production of preforms. Owing to the high bulk factor of the Durez 1900 series, deeper preform cavities are required. Otherwise, thin preforms will result. Introduction of Durez 1905 Black further increases the scope of phenolic plastic applications for parts requiring a high-impact material.

To obtain additional information on equipment described on this page, see lower part of page 158.

Some Results Obtained by Machining with Rexalloy Tools

By LEO J. ST. CLAIR, President
General Tool & Die Corporation, East Orange, N. J.

"Rexalloy," a cast non-ferrous cutting material which has as its basic elements cobalt, chromium, and tungsten has, during the comparatively brief period that it has been available on the market, proved itself to possess unusual properties for many metal-cutting purposes. Outstanding among its characteristics are its high degree of hardness at high temperatures and its strength and toughness under similar conditions.

In the following are given a few examples of machining operations that have been successfully performed with Rexalloy tools, including complete details as to speed, feed, depth of cut, etc. In rough-machining large semi-steel sheaves made with 40 per cent steel scrap, for large refrigerators, tools made from this material, cutting at 100 surface feet per minute, 1/8 inch feed per revolution, and from 1/2 to 3/4 inch depth of cut, completed a machining operation in 15.5 minutes that formerly required 22 minutes with the best tools then available.

In another instance, Nitralloy steel cylinders were turned with tools of this material at 70 surface feet per minute, with a 0.060 inch feed per revolution, in a cutting time of 4.4 minutes, as compared with 6.6 minutes using the best formerly available tools.

Another interesting example may be quoted. A crankshaft of very tough alloy steel, Brinell hardness 280, was machined with Rexalloy at 60 surface feet per minute and 0.060 inch feed per revolution. The cutting time was reduced from 20 minutes with the tools formerly used to 3.6 minutes, and the floor-to-floor time from 24 to 7.6 minutes; in other words, the production was increased more than three times. In this instance, the tool cost $4.85 and produced a direct labor saving of more than $15 a day.

Generally speaking, the best results are obtained from the new cutting material by increasing speeds and feeds over those used for high-speed steel, and increasing feeds greatly over those used with carbide tools. Usually, the amount of metal removed per minute should be doubled if the best operating results are expected. It is advisable to use as heavy a feed as possible, since this increases tool life, owing to the fact that it reduces the linear feet when the cutting edge of the tool is in contact with the work, and hence reduces the wear on the tool per piece. In many cases, doubling the feed has doubled the number of pieces produced between grinds. The increase in feed hardly affects the operating hardness of Rexalloy, while it would soften or cause breakage of other tools.

Too light a feed or too light a cut is not recommended. Work that must be produced with fine feeds is not as a rule, suitable for the new cutting material, except if the material is one that generates a great deal of heat even under a light cut or fine feed, such as stainless steel or tough alloy steels. For instance, long slender shafts require a fine feed, because a heavy feed would distort the shaft; but where heavy cuts can be taken, the examples cited indicate that unusual results can be obtained.

Slide Film on Steel Casting Design

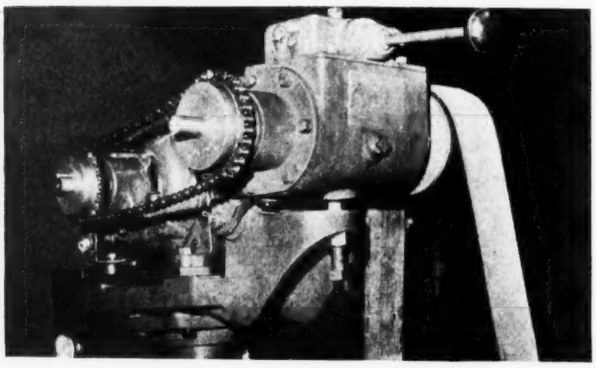
The Steel Founders' Society of America, 920 Midland Bldg., Cleveland, Ohio, has served for many years, as a clearing house for information on the design of steel castings. In order to answer comprehensively all the questions that arise, the Society has now prepared a sound slide film which explains known and tested principles of steel casting design. The film takes about thirty minutes to run, and is entertaining, as well as educational. The principles of design are simply and clearly brought out, and the film is certain to prove of value in many industrial fields.

The new film is available for showing before local sections of engineering societies. Sound and projection equipment can also be supplied without charge. Requests should be made to the Society at the address given above.

* * *

Aircraft Inspectors Urgently Needed

An examination has been announced for procurement inspectors in the Materiel Division, Air Corps, War Department, at Wright Field, Dayton, Ohio. Qualified persons are urged to apply at once. There are three grades of positions to be filled: Senior grade at $2600 a year; full grade at $2300 a year; and assistant grade at $2000 a year. Complete information can be obtained by addressing Secretary, Board of U. S. Civil Service Examiners, Wright Field, Dayton, Ohio; or Secretary, Board of U. S. Civil Service Examiners at any first- or second-class post office in the United States.



Western Transmission for Machine Tools Equipped with Chain Drive Made by the Morse Chain Co., Detroit, Mich., which Has the Advantage of a Positive Speed Ratio, Low Bearing Friction, due to Characteristic Slackness of Chain Drive, and Facility for Varying Speed Ratio by Changing One Sprocket and Adding or Removing Quickly Detachable Chain Links

Making Valve-Stems for Internal Combustion Engines by the Extrusion Process

The use of the extrusion process in making internal-combustion engine valve-stems, as applied in an English plant, is described in the following: Two dies are used — a roughing extrusion die and a finishing die, as shown in Fig. 1. A slug is first sheared (or sawn off in the case of high-grade valves) from a bar. The size of the slug depends upon the size of the valve and valve-stem. The slug is heated to the correct temperature and inserted in the extrusion die. The plunger of the press then enters the die, and the slug is forced downward into the taper. The stem of the valve is formed by the extrusion of the plastic hot metal. On the return stroke, the extruded valve is lifted by an ejector-pin and transferred to the finishing die, in which the rough head is pressed to final shape.

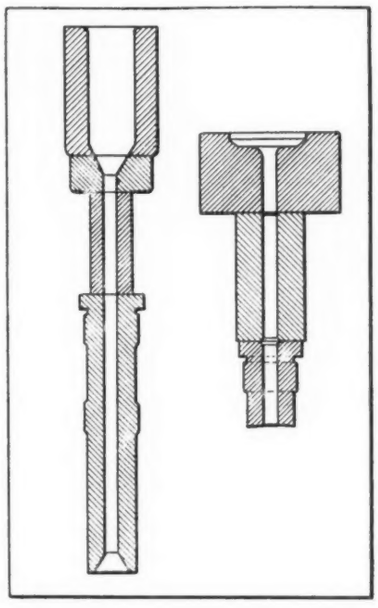


Fig. 1. Roughing and Finishing Extrusion Dies for Valve-stems

Close control over the grain flow is obtained in the extrusion process when the correct dimensions of the slug and taper of the die have been determined. Typical examples of grain flow are shown in Fig. 2. A valuable feature of the extrusion process is that, because of the squeezing action, the structure of the metal is closely knitted together, in contrast to the "bursting" effect, for example, in the electric upsetting process. The possibility of obtaining correctly shaped valves and valve stems rapidly is also a most important feature of the extrusion process.

* * *

Two New Screw Steels

A new Bessemer screw steel and a new open-hearth screw steel which are claimed to be equal or superior in machining qualities to any screw steels available in the past have been developed by the Union Drawn Steel Division of the Republic Steel Corporation. These steels are remarkably sound and dense in structure, and free from defects that cause internal seams and difficulties that lead to rejection of finished parts.

The new Bessemer steel, Union Maxcut, has physical properties comparable to S A E X1112. Parts made from it showed a smooth, fine finish when machined at 280 surface feet per minute with a feed of about 0.010 inch. The average tool life with this speed and feed was more than eleven hours. The use of lighter feeds, of course, permits higher cutting speeds. Union Maxcut responds to cyaniding and other casehardening processes in a manner similar to S A E X1112.

Union Multicut, the new fast cutting open-hearth steel, has physical properties similar to those of S A E 1115. Parts made from it, when machined at 275 surface feet per minute with a feed of about 0.009 inch, showed a finish comparable to that of Bessemer screw stock. The average tool life with this speed and feed was better than eight hours. With lighter feeds, this steel can be run up to 350 surface feet per minute with satisfactory results. Union Multicut can be carburized and hardened to a minimum casehardness of C 60 Rockwell with either single or double quench. It produces a very tough, ductile core in casehardened parts with a minimum of distortion in quenching.

Both steels have been tested on the automatic screw machine in the Union Drawn Steel Division's experimental laboratory in Massillon under conditions closely approximating actual production. They have also been used in production runs in the plants of a number of screw machine parts producers with very satisfactory results.

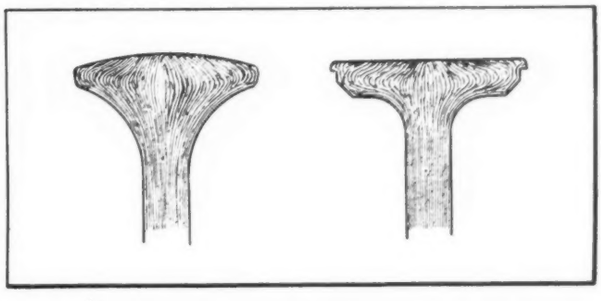


Fig. 2. Examples of "Grain Flow" in Extruded Samples

* * *

Work is the Basis of National Defense

The collapse of France has been attributed to many causes, and it is doubtless true that no single cause was responsible for the tragedy. It has frequently been pointed out, however, that the drastic reduction in working hours in French industry at the very time when France needed increased industrial production in order to produce the material required for defense had a serious effect on the outcome.

People in this country unfamiliar with the training and skill that is required for most industrial operations believe that short working hours have no effect on industrial output, since there are "eight or ten million Americans looking for work." They do not understand that these men cannot be immediately trained for the highly skilled work that is required, especially in the machinery industries.

As was pointed out in the *New York Times*, it is as foolish to talk of relieving the shortage of skilled airplane mechanics by taking on unemployed needleworkers, as it would be to try to make up a shortage of airplane motors by a surplus of women's dresses. Yet such is the logic advanced by many of the men holding high public office.

What we need first of all is that the capable men now aiding the Government in an advisory capacity be given authority to act and to produce results without political interference.

BROWN & SHARPE ELECTRICAL CONTROL

BROWN &

—FOR RAPID AND PRECISE MILLING

An instance of *Electrical Control* pioneered by Brown & Sharpe—the No. 12 Plain Milling Machine.

Outstanding for —

- – – RAPIDITY AND PRECISION OF MOVEMENTS of both table and spindle
- – – FLEXIBILITY OF PERFORMANCE gives maximum efficiency on both long and short run work
- – – WIDE CHOICE OF MILLING CYCLES
- – – SMOOTH AND QUIET OPERATION
- – – CONVENIENT ADJUSTMENTS for fast, easy set-up
- – – SAFETY PROTECTION for both machine and operator
- – – CLIMB MILLING for efficient milling of pieces usually difficult to hold
- – – DEPENDABILITY AND LASTING ACCURACY

B·S

Operators find Electrical Control requires minimum effort and gives greater production — particularly worthwhile on fast jobs like that shown at the left.

Ask for complete details of Electrical Control on Brown & Sharpe Milling, Grinding and Screw Machines.

Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

& SHARPE

NEWS OF THE INDUSTRY

Indiana

L & J Press Corporation, Elkhart, Ind., has taken over the business of the Loshbough-Jordan Tool & Machine Co., also of Elkhart. The latter company has been engaged for the last twenty-six years in building open-back inclinable punch presses. The principals of the new corporation are J. M. Hartgering and D. R. Grossman, of Detroit. Mr. Hartgering is a mechanical and metallurgical engineer with many years of experience in designing and building heavy construction machinery. Mr. Grossman has had twenty-five years manufacturing and selling experience, and has for the last thirteen years, been general manager of the Studebaker Corporation of Canada, Ltd., at Windsor, Ontario. The previous staff will continue with the business.

Bantam Bearings Corporation, South Bend, Ind., announces that new office and factory additions to the plant will be ready for use in about a month. These additions—the fourth in a six-year period—have been necessitated by the steadily increasing demand for quill, roller, and ball bearings. About a third more floor space will be added to the present factory area to accommodate the new equipment and facilities.

Illinois

American Stock Gear Co., 646 W. Washington Blvd., Chicago, Ill., is erecting a new plant to meet the increased demand for the company's product, particularly in the airplane and Diesel engine fields. The plant is designed to increase the production at least 50 per cent, and will permit the addition of much new equipment. It will be one story in height, and will contain about 30,000 square feet of floor space, an additional 40,000 feet of ground having been obtained for future expansion. The new plant is expected to be ready for occupancy about January 1.

B. L. Waters, formerly president of Lyon Metal Products, Inc., Aurora, Ill., has been elected chairman of the board, and Earl D. Power has been promoted to the position of president. Mr. Waters succeeds H. A. Gardner, who has resigned. Mr. Power was formerly vice-president and general manager. He joined the company twelve years ago as manager of one of the sales divisions. Previous to that, he was connected with the White Motor Co. of Cleveland in the capacity of assistant to the vice-president and general manager.

Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago, Ill., manufacturer of the Marvel line of hacksawing machines, band-sawing machines, hacksaw blades, and kindred tools, has started construction on an addition to its plant that will increase the manufacturing floor space and capacity nearly 100 per cent. The present plant was constructed only three years ago.

Michigan

Vinco Tool Co. announces that the firm name has been changed to Vinco Corporation, and the company has been moved from 7350 Central Ave., Detroit, Mich., to 9111 Schaefer Highway, where four times the previous floor space is available. The company manufactures spline gages, gear-tooth gages, built-up gages, master gears, and similar types of tools.

Koebel Diamond Tool Co. has just moved into a new factory on Grinnell Ave., Detroit, Mich. The new plant, of attractive modern design, will make it possible to meet the increased demand for Koebelite industrial diamonds and allied products of the company.

Detroit International Trading Corporation, 544 Insurance Exchange Bldg., Detroit, Mich., has been appointed exclusive export agent of the H & H Research Co., 1925 W. Buena Vista, Detroit, manufacturer of "Multi-purpose" electrical tools.

L. M. Gear Co. announces that it has moved from 7203 Gratiot Ave., East Detroit, Mich., to new and more modern quarters at 23120 Gratiot Ave. The new plant affords approximately 13,000 square feet of floor space.

Hyatt Engineering Co., designing engineers, are now established in their new location at 6605 Walton St., Detroit, Mich. The company specializes in the design of progressive dies and automatic machinery.

Accurate Tool Co., manufacturer of special machinery, tools, jigs, and fixtures, has moved from 7540 Joseph Campau, Detroit, Mich., to a new plant at 3535 McNichols Road, East.

New England

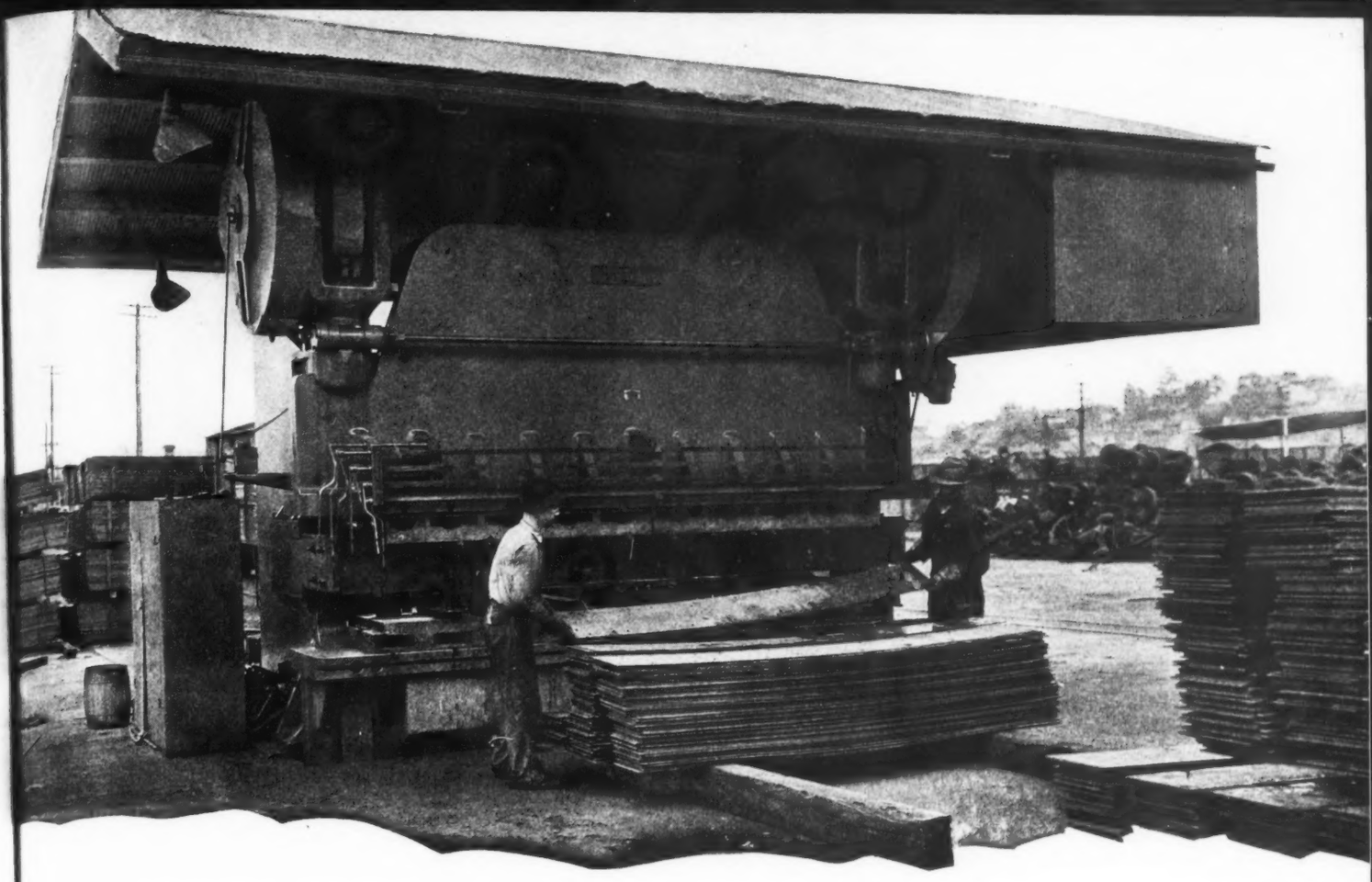
Howard M. Hubbard has been elected president of the Greenfield Tap & Die Corporation, Greenfield, Mass., succeeding Donald G. Millar, who has become chairman of the board. Colonel Frederick H. Payne, formerly chairman of the board, has resigned to devote his entire time to national defense work as chief of the Hartford Ordnance District. Mr. Hubbard has been associated with Harris-Seybold-Potter Co., manufacturer of printing presses, for the last ten years. He holds the degree of Bachelor of Mechanical Engineering and is a graduate of the Harvard Graduate School of Business. He has had a wide experience in the field of industrial management, including production, finance, and marketing.

Howard M. Hubbard, Newly Elected President of the Greenfield Tap and Die Corporation

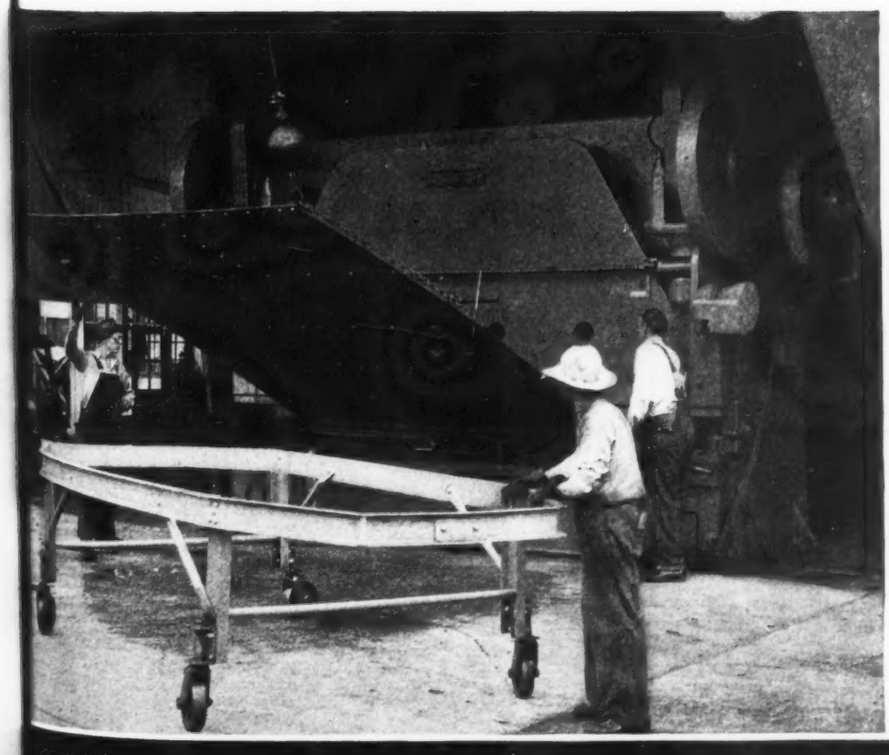
Milton P. Higgins, resident manager of the Norton electric furnace plant at Chippawa, Ontario, Canada, for the last two years, has been transferred to the Worcester headquarters as assistant manager of abrasive production and research. Mr. Higgins has been with the Norton Co. for about twelve years. Previous to holding the Chippawa post, he was manager of sales research at Worcester and in special sales work in the Chicago territory. He is a director of the Norton Co., and also of its Behr-Manning Division.

Anderson & Sons, manufacturers of nameplates, signs, dials, and novelties, formerly located in Springfield, Mass., have moved to Westfield, Mass., where they have a large, up-to-date plant for producing all types of decorative products by the etching, lithographing, and embossing processes from all kinds of metal and with a great variety of finishes.

Francis A. Smith, for several years vice-president and general manager of the Greenfield Tap & Die Corporation,



Paid For Itself In Four Months



ON one job alone, required for the rebuilding of 1800 hopper cars, the above recently installed 400 series Cincinnati All-Steel Press Brake completely refunded the investment in four months.

● ● ● ● ●

At the left is another CINCINNATI PRESS BRAKE working for a railroad. Job illustrated—bending end on hopper chute. Records show that this unit has refunded the investment at least four times during its 3 years of service.

Every plan for modernization or new car construction should include the economies which can be effected with Cincinnati All-Steel Press Brakes.

Write for recommendations on your job.

THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO

Greenfield, Mass., has resigned. He has been associated with the company in various executive capacities for over twenty years.

STEARNS, PERRY & SMITH, 51 Chardon St., Boston, Mass., have been appointed district agents for the Boston territory by the JANETTE MFG. CO., 556 W. Monroe St., Chicago, Ill., manufacturer of speed reducers, rotary converters, motor-generators, and blower wheels.

SPARKS-SIMPLEX MACHINERY CORPORATION, 49 Wall St., Norwalk, Conn., has been formed by S. W. Sparks and C. Nelson Sparks for the purpose of designing and engineering machines and equipment for shell manufacture. The company will act purely in an engineering capacity and not as a sales or manufacturing agency. S. W. Sparks designed for the United States Government, during the last war, machines that were installed in the Watervliet Arsenal for making large and medium-sized field guns. The Sparks-Simplex machine now designed for shell manufacture in two sizes is expected to make possible great increases in the speed of manufacturing shells.

New York and New Jersey

L. W. REINKEN, electrical engineer, has joined the staff of the W. Green Electric Co., Inc., 192 Broadway, New York City, manufacturer of selenium rectifiers for electroplating. Mr. Reinken was formerly with the International Telephone Development Co., and recently returned to the United States after spending eight years abroad, where he was engaged in supervising the promotion of selenium rectifiers.

S. P. BROOME has been appointed special representative of the Crucible Steel Co. of America, 405 Lexington Ave., New York City. Mr. Broome will cooperate with the National Defense Advisory Commission. He was formerly eastern sales manager of the Crucible Steel Co.'s subsidiary, the Pittsburgh Crucible Steel Co.

E. ARTHUR BALDWIN and OTTO PRUESSMAN, vice-presidents and European and Far Eastern managers, respectively, of the International General Electric Co., have retired.

RAYBESTOS-MANHATTAN, INC., has announced that it has purchased the Brighton Mills plant adjacent to the main plant of the Manhattan Rubber Mfg. Division of the company at Passaic, N. J. The property includes approximately 5 1/2 acres on which there are buildings affording 240,000 square feet of floor space.

CALLITE TUNGSTEN CORPORATION, 544 Thirty-ninth St., Union City, N. J., has added approximately 100,000 square feet of floor space to its manufacturing facilities through the acquisition of a large factory in the neighborhood of its main plant.

Ohio

HYDRAULIC PRESS MFG. CO., Mount Gilead, Ohio, has recently established a new plastics laboratory under the supervision of WARREN R. TUCKER, who has been development and sales engineer for the company's plastic presses for several years. The laboratory was originated to assist the plastic molder in solving difficult molding problems and to provide him with presses for experimental work. The molder thus has the opportunity of seeing the molding job run in a standard press before he actually invests in press equipment; suggestions as to the making of test dies are furnished. The laboratory will also be used for development work in plastic molding presses.

REIN & WEBSTER, INC., have recently established offices, as manufacturers' representatives, at 1412 Keith Bldg., Cleveland, Ohio, to supply manufacturers in Ohio, Pennsylvania, Indiana, and Michigan with a full line of die-castings, plastics, rubber moldings, stampings, and screw machine products. The president of the new company is FRANK H. WEBSTER, and the secretary-treasurer JOHN A. REIN. The firms represented by the company are the LATROBE DIE CASTING CO., Latrobe, Pa.; ZENITH PLASTICS, INC., Cleveland; ACKERMAN PLASTIC MOLDING CO., Cleveland; METAL SPECIALTIES, INC., Cincinnati, Ohio; and DELO SCREW PRODUCTS CO., Delaware, Ohio.

METAL CARBIDES CORPORATION, 107 E. Indianola Ave., Youngstown, Ohio, manufacturer of tungsten-carbide tools, dies, and parts subject to wear, sold under the trade name "Talide," has appointed W. A. SCHOFIELD Michigan representative, with offices at 6432 Cass Ave., Detroit, Mich., and R. L. WOLFE Indiana representative, with offices at 302 Berkley Road, Indianapolis, Ind.

C. W. SWEENEY has been placed in charge of the operations of the Bunting Brass & Bronze Co., Toledo, Ohio, on the Pacific Coast. He will be assisted by WALTER GARDNER, who has been in charge of the Bunting warehouse in San Francisco for the last seven years. Stocks of all Bunting products and a consulting service on special bearing requirements will be available at the Pacific Coast headquarters.

OHIO GEAR CO., 1333 E. 179th St., Cleveland, Ohio, has been appointed national distributor for the complete line of V-belts and multiple pulleys manufactured by the Browning Mfg. Co., Maysville, Ky.

C. J. MILLER, president of the Fremont Foundry Co., Fremont, Ohio, was elected president of the Gray Iron Founders' Society at the annual meeting held in Cleveland, September 12.

GEORGE A. MOHR has been elected secretary of the Boye & Emmes Machine Tool Co., Cincinnati, Ohio, manufacturer of engine lathes.

Pennsylvania

W. RICHISON SCHOFIELD, formerly chief engineer of the Leeds & Northrup Co., Philadelphia, Pa., has recently been appointed director of engineering. JOHN W. HARSCH, assistant chief engineer, has been advanced to the position of chief engineer, and Mr. Harsch's former position has been filled by JOHN F. QUEREAU.

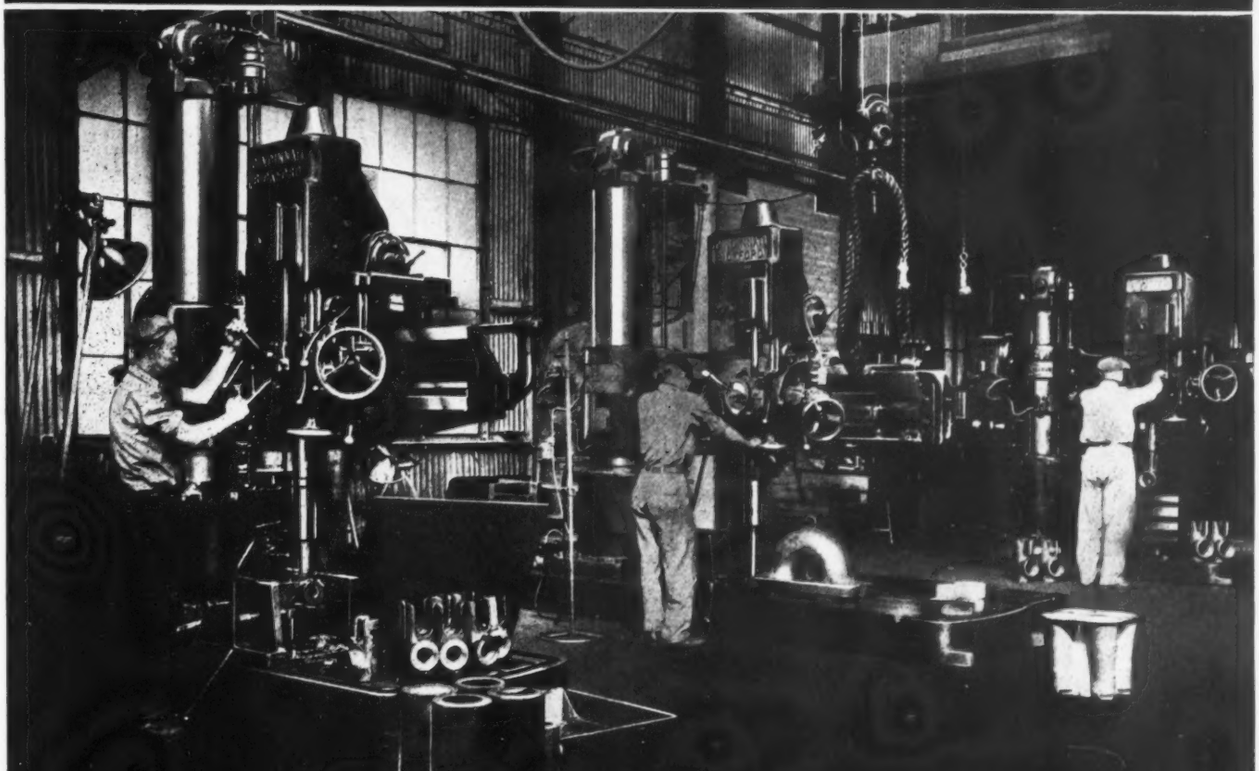
Photo Blank & Stoller

W. Richison Schofield, New Director of Engineering of the Leeds & Northrup Co.

John W. Harsch, Newly Appointed Chief Engineer of the Leeds & Northrup Co.

Throughout Industry...

THIS SUPER C·B SERVICE TRADEMARK MEANS "MORE HOLES PER DOLLAR"!



For Example: IN PRODUCING OIL REFINING EQUIPMENT

The Key Company of St. Louis makes specialized equipment for oil refining and cracking processes—for which these Cincinnati Bickford Super Service Radials prove to be most successful and efficient. The first is performing a tapping operation on a terminal fitting. The second, spotfacing operation on a 475 lb. 180° u-bend. The third, reaming operation on a tapered seat. Below is a close-up of a large ten-hole header and elbow which was machined throughout on the first two Radials.

For improved production, study the advantages described in Bulletin R-24. Your copy will be sent free upon request.

THE CINCINNATI BICKFORD TOOL CO.

OAKLEY · CINCINNATI · OHIO · U. S. A.

Mr. Schofield joined the Leeds & Northrup Co. in 1916, and since 1928 has held the position of chief engineer. An authority in pyrometry and automatic control, he holds important patents in these fields. Mr. Harsch became connected with the company in 1924, and in 1928 became assistant chief engineer. He is largely responsible for the design of the Homo tempering and Homocarb carburizing furnaces. Mr. Quereau has been connected with the company since 1929, and is the inventor of a number of thermocouple and resistance thermometer devices.

EDWARD W. VOSS, Pittsburgh machinery manufacturer and head of the organization bearing his name, announces the appointment of FRANK W. ROBERTSON as general manager of both the Ungerer leveler and the machine tool divisions. Mr. Robertson was formerly sales manager of the Ungerer leveler division. CLYDE DEVILLING, formerly of the Universal Cyclops Steel Corporation, has been placed in charge of heavy machinery sales.

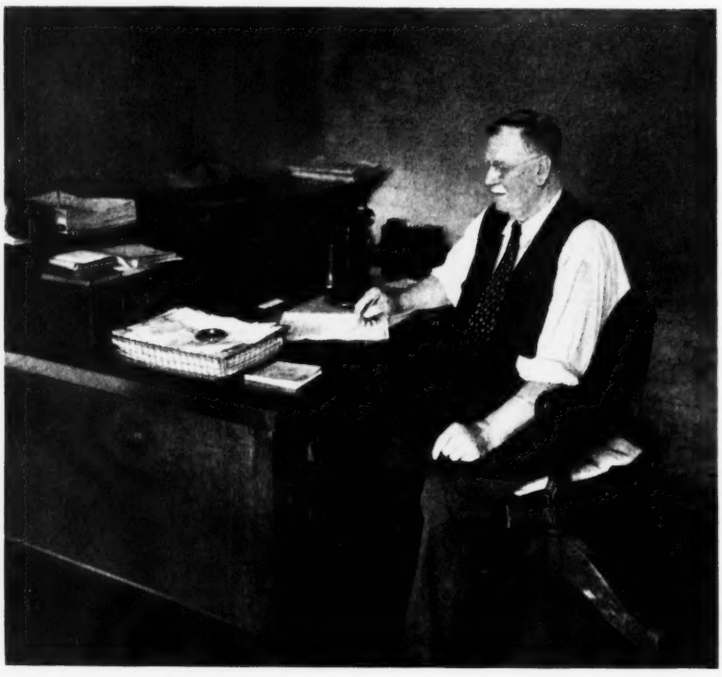
HARRY WILSON, SR., recently celebrated his sixty-fifth year of service with the Jessop Steel Co., Washington, Pa., and its parent concern, Jessop of Sheffield, England. Mr. Wilson is the fourth direct descendant of Wilsons who have worked continuously for this company from 1774 to the present time. He began working for the parent concern at the plant in Sheffield, England, in 1875, when he was eleven years old, starting as a screw boy in the sheet mills. In 1905, he was sent to America, where he became night superintendent of the sheet mills in the new plant that the Jessop Steel Co. had just established in Washington, Pa., as a subsidiary of the Sheffield firm. He held that position until 1938, when he was given less onerous employment. It is of interest to note that four other Wilsons (sons and grandsons of Harry Wilson) are employed at the present time by the Jessop Steel Co. in this country.

JONES & LAUGHLIN STEEL CORPORATION, Pittsburgh, Pa., announces that the corporation has been granted patents on the method of manufacturing steel by Bessemer flame control, a process of controlling the end-point of the Bessemer blow by photo-electric cells, thereby preventing over- and under-blowing of the charge and assuring uniformity of the steel.

JESSOP STEEL CO., Washington, Pa., announces that, at the annual stockholders' meeting, the following officers were re-elected: President, R. EDSON EMERY; vice-president and treasurer, FRED T. H. YOUNGMAN; and secretary, ROBERT J. MURRAY.

ROBERT H. PERRY has become sales engineer for the Ajax Electric Co., Inc., Philadelphia, Pa., and will be located in Buffalo, N. Y. He was formerly with the Brown Instrument Co.

ELWOOD G. STEWART, who has been acting traffic manager of the Lukens Steel Co., Coatesville, Pa., since November, 1939, has been appointed traffic manager.



Harry Wilson, Sr., Who Recently Celebrated His Sixty-fifth Year of Service with the Jessop Steel Co., and its Parent Concern, Jessop of Sheffield, England

Wisconsin and Minnesota

GEORGE M. CLASS, formerly chief engineer of the Gisholt Machine Co., Madison, Wis., has recently been promoted to the position of vice-president in charge of engineering. FREDERICK L. CHAPMAN, previously assistant sales manager, has been appointed sales manager. ROY HUNTER and P. ROBERT FOSEID have been appointed to the sales force, and will handle the complete line of Gisholt turret lathes, automatic lathes, and balancing machines. Mr. Hunter will be in charge of the Cleveland office, located in the N.B.C. Bldg., Cleveland, Ohio, and Mr. Foseid, who was previously in the service department, will make his headquarters at Philadelphia, Pa., handling eastern Pennsylvania, southern New Jersey, Delaware, and Maryland.

CHESTER H. NORTON, purchasing agent at the Boston Works of the Allis-Chalmers Mfg. Co., has been appointed assistant general manager of purchases and has been transferred to the company's main offices in the West Allis Works at Milwaukee. H. W. HAUSER, formerly with the company's purchasing department in Milwaukee, will succeed Mr. Norton as purchasing agent at the Boston Works.

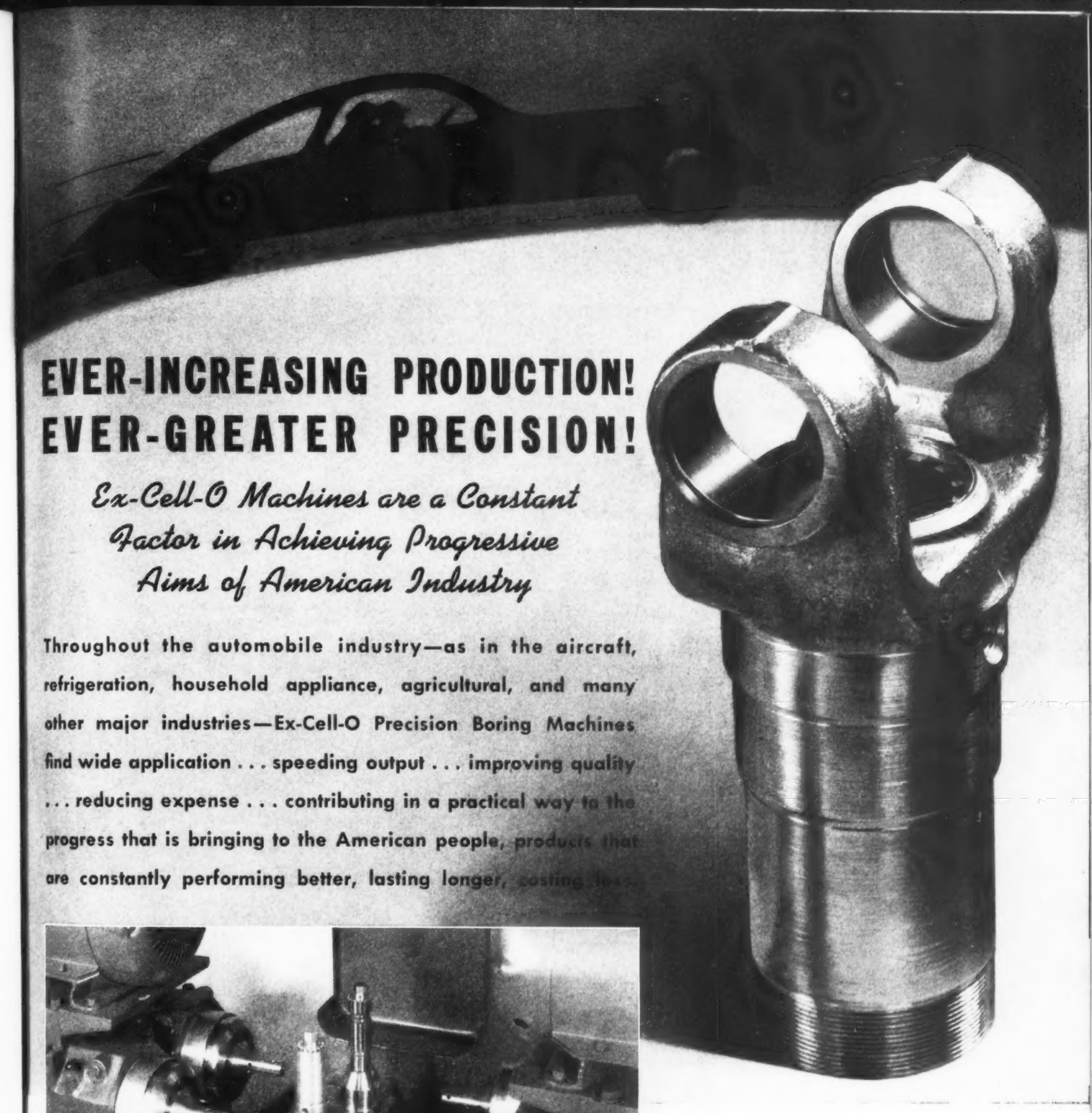
J. A. BUTLER has been appointed comptroller of the Falk Corporation, Milwaukee, Wis. He is a graduate of the Hamlin University, St. Paul, Minn., and has been with the Falk organization for the last four years.

CHAIN BELT CO., Milwaukee, Wis., announces the removal of its Minneapolis office from 808 LaSalle Ave. to 1645 Hennepin Ave., where larger space and increased service facilities are available. R. X. RAYMOND, who has been associated with the company for over twenty years, is Minneapolis district manager.

Texas and Georgia

RELIANCE ELECTRIC & ENGINEERING CO., 1088 Ivanhoe Road, Cleveland, Ohio, is opening a sales office in Houston, Tex., with FRANK A. DENISON, JR., as district manager. Mr. Denison was previously a member of the sales engineering staff at the Detroit office of the company. TINKHAM VEALE, of the sales service department of the company, will take Mr. Denison's place on the sales engineering staff at Detroit.

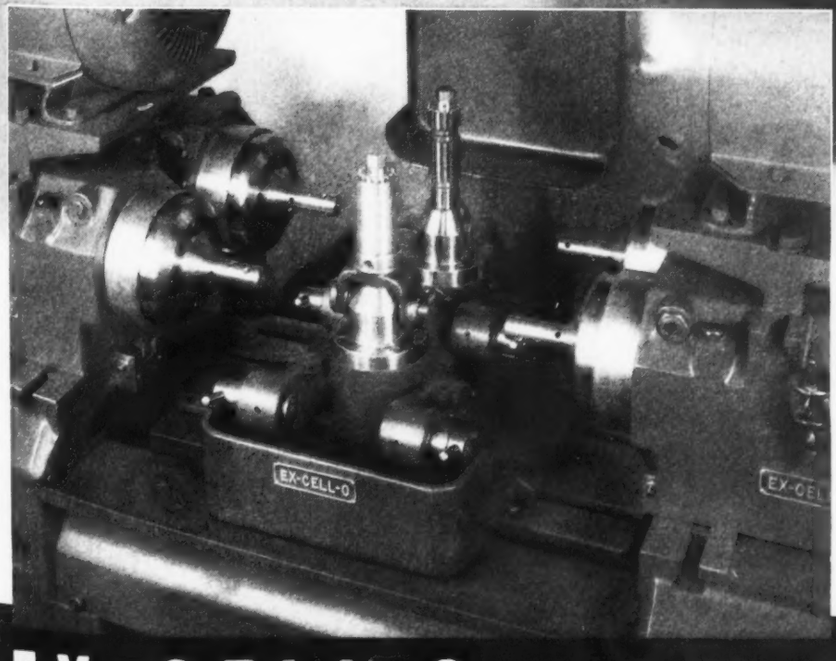
M. J. MCKEEVER has been appointed manager of the Crucible Steel Co.'s Atlanta Branch at 381 Whitehall St., Atlanta, Ga. Mr. McKeever has been connected with the company for fifteen years, and has been stationed at the Atlanta branch since 1927. He is a graduate of the Rose Polytechnic Institute.



EVER-INCREASING PRODUCTION! EVER-GREATER PRECISION!

Ex-Cell-O Machines are a Constant Factor in Achieving Progressive Aims of American Industry

Throughout the automobile industry—as in the aircraft, refrigeration, household appliance, agricultural, and many other major industries—Ex-Cell-O Precision Boring Machines find wide application . . . speeding output . . . improving quality . . . reducing expense . . . contributing in a practical way to the progress that is bringing to the American people, products that are constantly performing better, lasting longer, costing less.



● Illustrated is a typical Ex-Cell-O Precision Boring application, one of many automotive parts finished to close limits at a high production rate on an economical basis. Machine: Ex-Cell-O Double End Junior; Part: Universal Joint Knuckle; Operation: Rough bore, finish bore, counterbore; Diameter bored: 1.1873"; Length of cut, 2⅛"; Tolerance: ± .0003".

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COMING EVENTS

OCTOBER 7-11—NATIONAL SAFETY CONGRESS AND EXPOSITION to be held at the Stevens Hotel, Chicago, Ill., under the auspices of the National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

OCTOBER 8-12—SOUTHERN POWER AND ENGINEERING SHOW in the Armory Auditorium, Charlotte, N. C. For further information, address Junius M. Smith, vice-president, Southern Power and Engineering Show, Inc., P. O. Box 1225, Charlotte, N. C.

OCTOBER 14-16—Twenty-third semi-annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION to be held at Skytop Lodge, Skytop, Pa. J. C. McQuiston, manager-secretary, 602 Shields Bldg., Wilkinsburg, Pa.

OCTOBER 17-19—Semi-annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS at the Hotel Gibson, Cincinnati, Ohio. Ford R. Lamb, executive secretary, 2567 W. Grand Blvd., Detroit, Mich.

OCTOBER 21-22—Annual convention of the ASSOCIATED MACHINE TOOL DEALERS OF AMERICA at Dayton, Ohio. Thomas A. Fernley, Jr., executive-secretary, 505 Arch St., Philadelphia, Pa.

OCTOBER 21-25—NATIONAL METAL EXPOSITION, to be held at Cleveland, Ohio, under the auspices of the American Society for Metals. W. H. Eisenman, secretary, 7301 Euclid Ave., Cleveland, Ohio.

OCTOBER 25-26—Annual meeting of the FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION at the Homestead Hotel, Hot Springs, Va. Arthur J. Tuscany, executive secretary, Penton Bldg., Cleveland, Ohio.

OCTOBER 30-NOVEMBER 1—Annual meeting of the MEEHANITE RESEARCH INSTITUTE OF AMERICA at the Hotel Schroeder, Milwaukee, Wis. For further information, address the Meehanite Research Institute, 311 Ross St., Pittsburgh, Pa.

OCTOBER 31-NOVEMBER 2—National Aircraft Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Biltmore, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

NOVEMBER 8-9—NATIONAL TIME AND MOTION STUDY CLINIC to be held at the Chicago Towers Club, Chicago, Ill., under the auspices of the Industrial Management Society. For further information, address W. F. Entorf, Industrial Management Society, 205 W. Wacker Drive, Chicago, Ill.

DECEMBER 2-5—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in New York City. C. E. Davies, secretary, 29 W. 39th St., New York City.

DECEMBER 2-7—Fourteenth NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING to be held at the Grand Central Palace, New York City. For further information, address International Exposition Co., Grand Central Palace, New York City.

JANUARY 6-10, 1941—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

MARCH 24-29, 1941—MACHINE AND TOOL PROGRESS EXHIBITION at Convention Hall, Detroit, Mich., under the auspices of the American Society of Tool Engineers, 2567 W. Grand Blvd., Detroit, Mich.

APRIL 1-3, 1941—Spring meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Atlanta, Ga. C. E. Davies, secretary, 29 W. 39th St., New York.

OBITUARY

George C. Newell

George C. Newell, for thirty-five years connected with the Brown & Sharpe Mfg. Co., Providence, R. I., in various capacities, died August 25 after a brief illness, at the age of fifty-nine years. Mr. Newell was born in Fall River, Mass. After leaving high school, he served a machinist apprenticeship with Fyans, Fraser & Blackaway Machine Co., of Fall River. Later he worked for several machine-building companies, and went with the Brown & Sharpe Mfg. Co. in 1905. After serving as assistant foreman and foreman, he was made assistant to the works superintendent in 1917, which position he held until he was placed in charge of the Cincinnati office in 1929. Following the closing of this office a few years later, he returned to the sales department in Providence. Last year he assumed the duties of supervising the purchasing of plant equipment, which position he held at the time of his death.

Mr. Newell was widely known in the machinery field and had a great many friends, not only within the Brown & Sharpe organization, but throughout industry. He is survived by his widow, Anna B. Newell, and two daughters, Mrs. A. R. Newsan and Mabel Newell.

Increasing Business Volume in the Machinery Field

Expanding peacetime and preparedness activity is reflected in the amount of business booked by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., during the month of August, which was the biggest month in the history of the company. During that month, orders received by the company amounted to $57,352,000, with employment approaching the peak months of 1929 and 1937. The August business was 69 per cent greater than the new business in July. The new business for the first eight months of the year increased 67 per cent over the same period in 1939. The Westinghouse company's previous record month was October, 1917, when orders amounting to $50,000,000 were received. Of the orders received in August, 1940, over $36,000,000 worth were connected with the Government's Preparedness Program.

Eliminating the business received from the Government, the remaining peacetime business, approximating $21,000,000, would still be comparable to the best peacetime business in the company's history. Even in the boom year of 1929, the Westinghouse orders for a single month never exceeded $25,000,000.

* * *

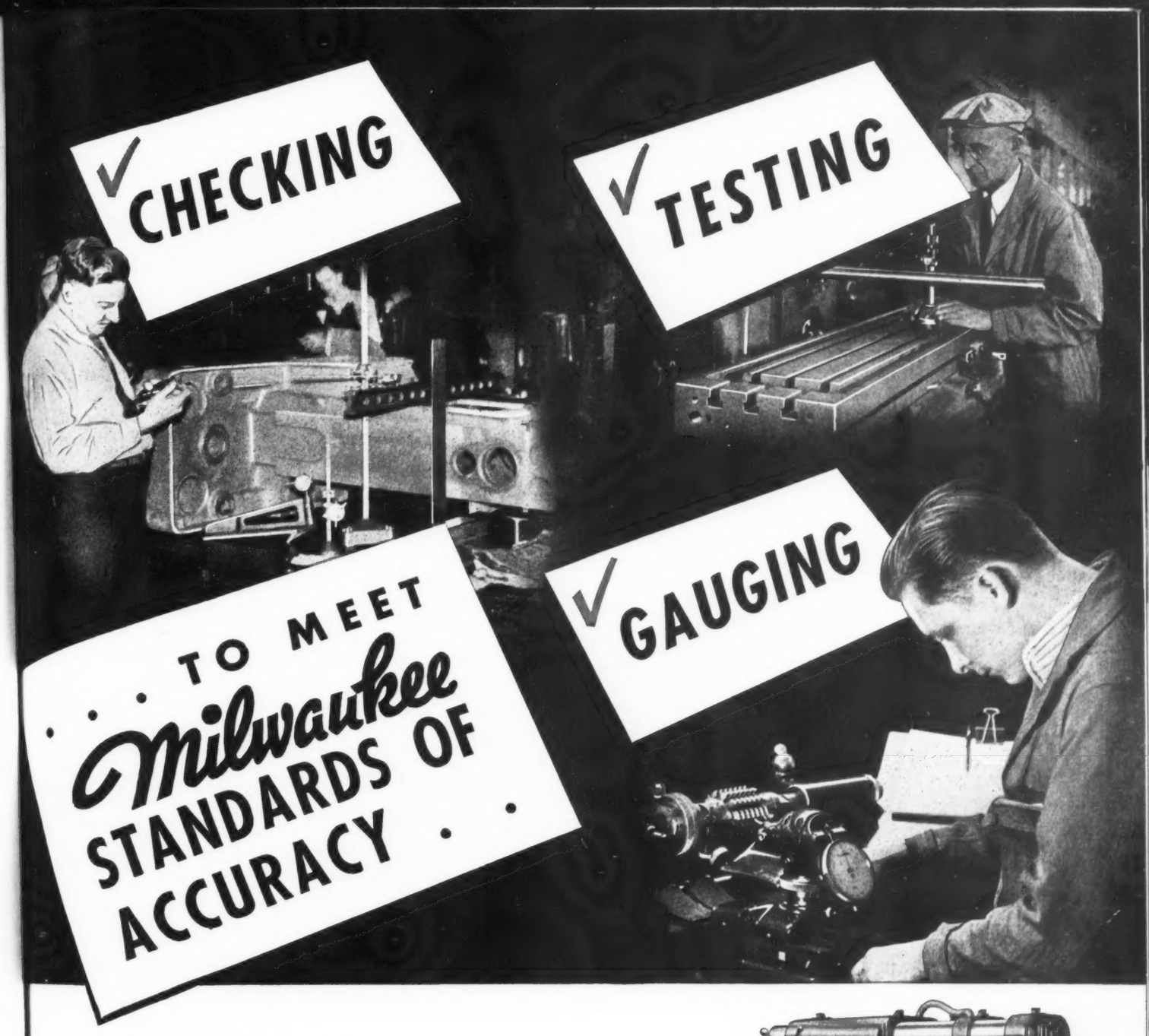
Production of Carbide Tools Increases

The Carboloy Company, Inc., Detroit, Mich., reports that, in the month of July, the production of Carboloy for steel cutting was about four times as great as during July, 1939, and well in excess of the production in June this year, which was the previous peak month. This applies to tantalum and titanium carbides, the principal alloys used for machining steel. Increased use of carbides for machining cast iron and non-ferrous metals is also reported. The Carboloy production in July, this year, for such purposes was close to 80 per cent ahead of that for July, 1939.

* * *

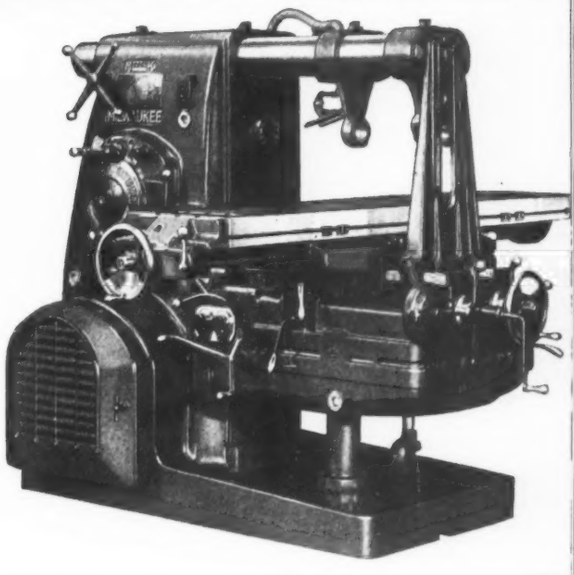
Sharp Rise in Gear Production Reported

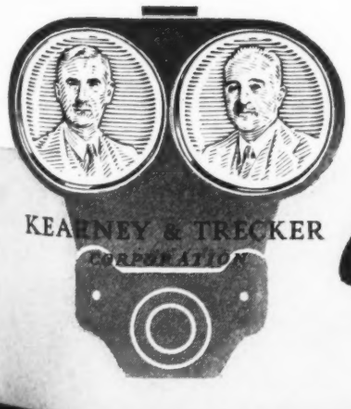
The American Gear Manufacturers Association reports that gear sales during the month of August, the last month for which complete figures are available, were 35.5 per cent above the sales of July, this year, and practically double the sales of August, 1939. The sales during the eight months ending with August, 1940, were 46 per cent above the sales for the corresponding period last year. The gear industry is considered an accurate barometer of conditions in the industrial field in general, because of the fact that gears enter into most industrial equipment.



A LARGE staff of highly trained technical men — constantly checking, testing, and gauging at every stage of construction and assembly — make sure that every part — every unit — measures up to Milwaukee standards of milling machine quality and accuracy.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN





Milwaukee MILLING MACHINES

NEW BOOKS AND PUBLICATIONS

THE STORY OF SUPERFINISH. By Arthur M. Swigert, Jr. 672 pages, 6 by 9 inches; 720 illustrations. Published by the Lynn Publishing Co., Detroit, Mich.

Because there was no book devoted to the many aspects and applications of the finish of metal surfaces, the author of this work, who is director of production research for the Chrysler Division of the Chrysler Corporation, Detroit, Mich., has endeavored, in this comprehensive treatise, to develop his theme from elementary principles, in order to clearly present the more advanced technical information. At the same time, as he states in the preface, he has endeavored to show that the subject of metallic surface finishes, "while it embraces all branches of science and technology, is fundamentally based on common sense."

This book, because of its completeness, will become, without doubt, a standard work of reference, not only on Superfinish, but on metal finish in general. In a brief review, it is not possible to give a comprehensive idea of the great scope of this work. Probably the best that can be done is to call attention to the subjects dealt with in its many chapters, each of which is a treatise in itself.

Some of the chapter headings are: The Importance of Surface Finish; The Reasons for Surface Finish; Surface Finish Nomenclature; Measuring Surface Finishes; Machined Surface Finish; Metallic Tools; Turning Method of Surface Finishing; Abrasive Tools; Grinding Method of Surface Finishing; Refined Grinding Finishing Methods; The Beginning of Superfinish; Superfinishing Method of Surface Finishing; Internal Superfinishing and Bore Processing; Lubrication and Its Relation to Surface Finish; Metallurgy of Machined Surfaces; Material and Design of Bearings; Manufacturing and Engineering Advantages of Superfinishing; and Superfinishing Machines.

MANUAL DEL TORNERO. Spanish edition of a book the English title of which is "How to Run a Lathe." By J. J. O'Brien and M. W. O'Brien. 128 pages, 8 by 5 inches. Published by the South Bend Lathe Works, South Bend, Ind. Price, 25 cents paper-bound; 75 cents bound in leatherette.

This is a translation of the South Bend Lathe Works' handbook on the care and operation of screw-cutting lathes entitled "How to Run a Lathe," of which the thirty-sixth edition has just been published. In addition to being translated into Spanish, this book is also available in French, Portuguese, Dutch, and Swedish. The first edition was printed in English in 1907. Each succeeding edition has been revised and improved, and well over 1,500,000 copies have been printed in various languages.

It is the purpose of this book to aid the beginner or apprentice in the machine shop and the student in the manual training school shop and trade school to secure a better understanding of the fundamentals of the operation of modern screw-cutting lathes. In illustrating and describing the operations of modern lathe practice, an effort has been made to show only the best and most practical methods of machine shop practice now in use in up-to-date plants in the United States.

The book is of especial importance at the present time when one of the great needs of industry is well-trained workmen who are not only skillful with their hands, but who understand the underlying reasons for what they do, and who are capable of suggesting improvements. The book under review furnishes the basic foundation for such a training.

SIMPLE BLUEPRINT READING WITH SPECIAL REFERENCE TO WELDING. 138 pages, 6 by 9 inches. Published by the Lincoln Electric Co., Cleveland, Ohio. Price, 50 cents in the United States; 75 cents elsewhere.

This book affords a basis for the study of blueprint reading which, together with practice in the actual reading of drawings, will guide the student to proficiency in this important subject. While the book has been compiled primarily for welders, it contains information of value to anyone concerned with mechanical construction. With the help of this book, the student can learn, in a few hours' spare-time study, what it would take many months to pick up in the course of everyday work. It will enable welders, mechanics, and others to answer questions for themselves, thus saving the time of the welding supervisor or foreman. The various symbols used in drawing different types of welded joints are explained. The illustrations include examples of drawings of a number of machine parts, pipe connections, general construction, tanks, etc. A list of questions and answers is given to enable the student to test his knowledge.

MOTION AND TIME STUDY. By Ralph M. Barnes. 390 pages, 6 by 9 inches; 200 illustrations. Published by John Wiley & Sons, Inc., New York City. Price, $3.75.

This is the second edition of this work. The author, who is professor of industrial engineering and director of personnel at the College of Engineering of the University of Iowa, has enlarged many of the features of the book and included more illustrative material. The sections relating to process charts, operation analysis, visual direction and stop-watch time study have been amplified. Two chapters have been added on the setting of time standards. The book contains twenty-four chapters covering the details of motion and time study, including such subjects as film analysis; special applications, as, for example, gear-hobbing and can-soldering; time standards for die and tool work and for assembly operations; and a chapter on the training of the operator.

HANDBOOK OF PROCEDURE AND PRACTICES UNDER THE NATIONAL LABOR RELATIONS ACT. Prepared by W. A. Rinckhoff and Harvey B. Rector. 126 pages, 5 1/2 by 8 1/2 inches. Published by Law Research Service, 712 Keith Bldg., Cincinnati, Ohio. Price, $7.50.

The information in this book is based on actual experiences with labor organizations and with the National Labor Relations Board in the preparation, prosecution, and defense of alleged violations under the National Labor Relations Act. It is intended to help employers of labor to protect their constitutional rights against wrongful charges of labor unions. The chief problem confronting the employer is how to conduct his business in harmony with the Act, and how to defend himself against unjust charges of violating the Act. Many unfortunate occurrences in the past have been due to a lack of understanding of the provisions of the Act by employers and their attorneys. The object of this book is to provide such information as may be helpful to employers.

INFLUENCE OF CYCLIC STRESS ON CORROSION PITTING OF STEELS IN FRESH WATER, AND INFLUENCE OF STRESS CORROSION ON FATIGUE LIMITS. By Dunlap J. McAdam, Jr., and Glenn W. Geil. 65 pages, 6 by 9 inches. Published by the U. S. Department of Commerce, Washington, D. C., as Research Paper RP1307 of the National Bureau of Standards. Price, 10 cents.

WHERE TO FIND THE NEW TRADE NAMES. By Alice M. Amoss, librarian, Technical Library, Edgewood Arsenal. A bibliography of 32 pages, 6 by 9 inches. Published by Press of King Bros., Inc., Baltimore, Md. Price, 75 cents.

THE USE OF RADIANT ENERGY FOR THE APPLICATION OF HEAT. By Howard Haynes. 17 pages, 6 by 9 inches; 10 illustrations. Published by the General Electric Co., Nela Park, Cleveland, Ohio.